

Consulting Engineer

February 1960

ADOLF H. KOEBIG, JR., president of Koebig and Koebig, Los Angeles, California, has just passed a milestone which few engineers have been privileged to reach — his fiftieth year in private practice. Recognized as a pioneer in the field of modern sewage treatment, Koebig is also widely known as an authority in the design of water works, irrigation systems, and hydroelectric plants. His services as an expert witness

Continued on Page 12



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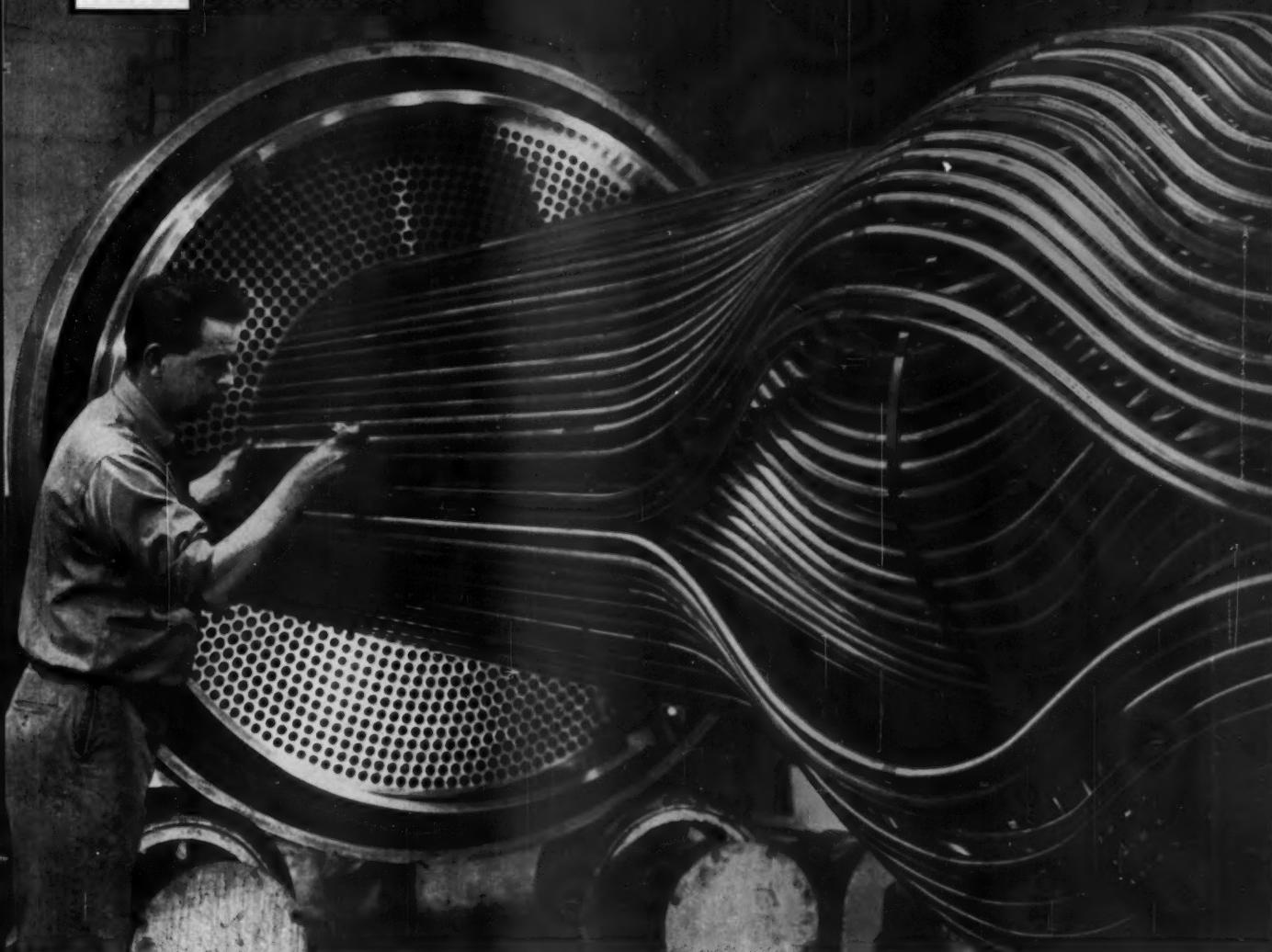
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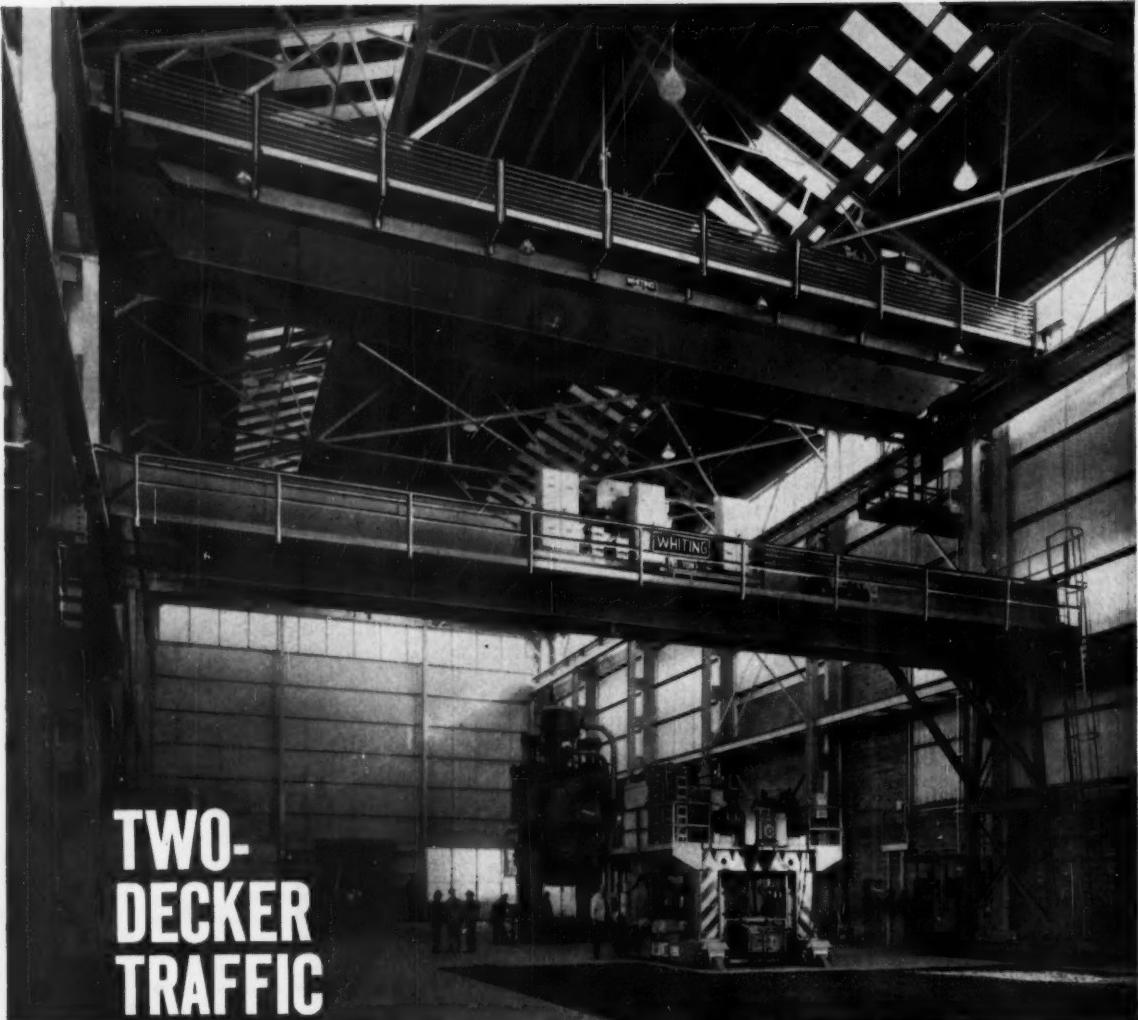
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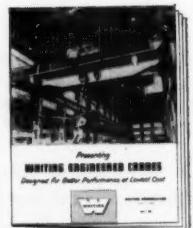
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February 1960 • VOLUME XIV • NUMBER II

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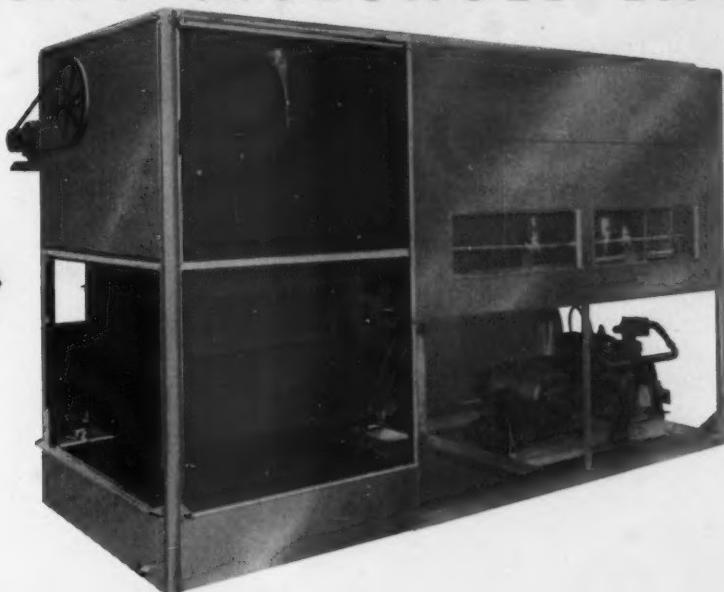
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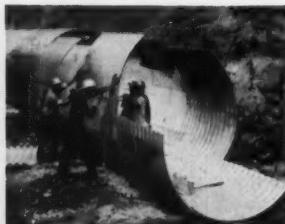
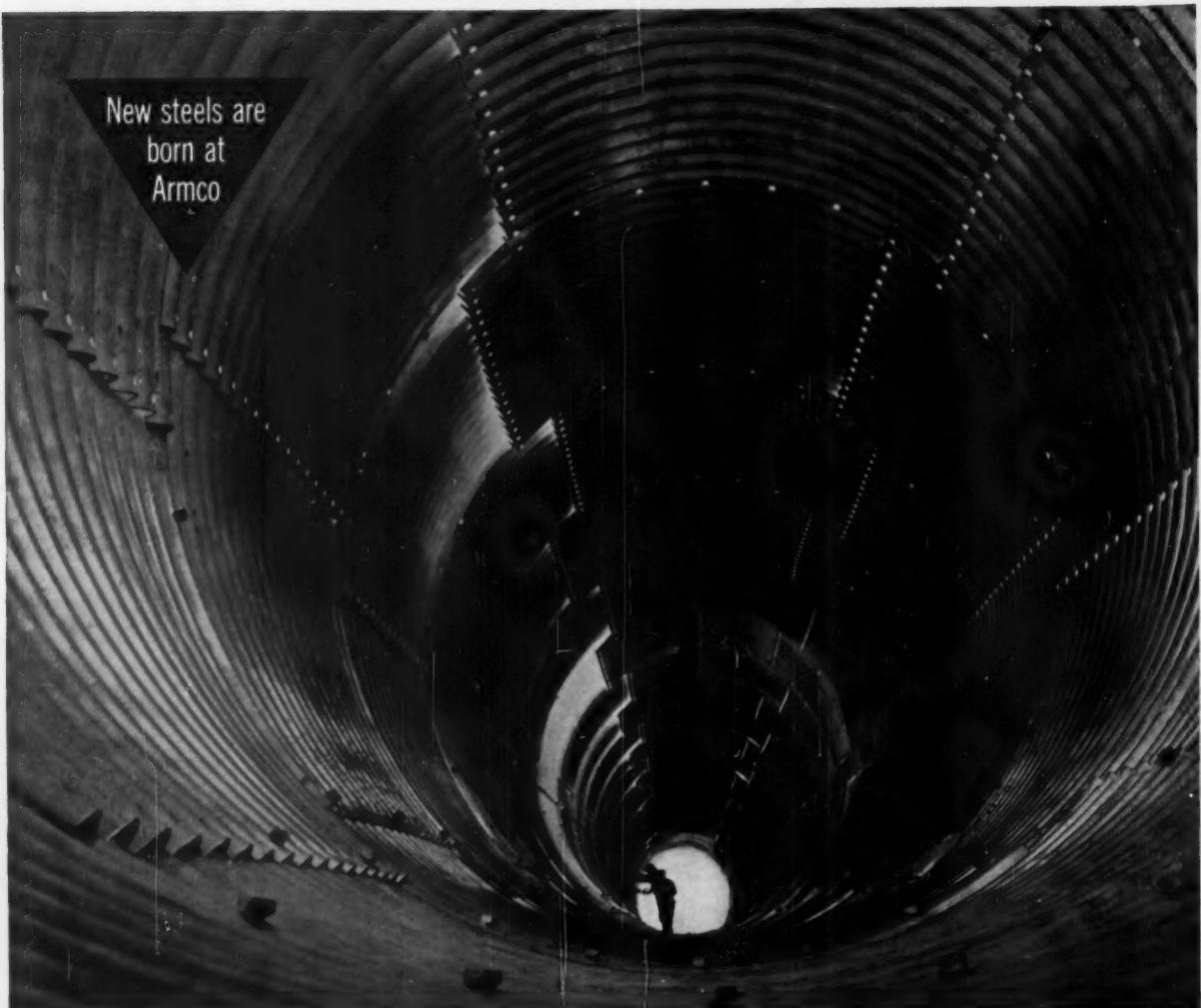
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Adolf H. Koebig, Jr.

— Starts on front cover

are in great demand in litigation involving his specialized fields of engineering.

Koebig was educated at Amherst College and Stanford University, and is a registered engineer in California, Arizona, Nevada, and Washington. The firm name, Koebig and Koebig, perpetuates a unique father and son professional relationship that has resulted in policies which have prevailed over half a century.

Koebig Firm Founded in 1888

To know the son, it is necessary to know something about the colorful career of the distinguished father, the late Adolf H. Koebig, Sr. It was he who began the private practice of civil, hydraulic, and hydroelectric engineering in 1888.

Born in 1852 in Prussia, Germany, the senior Koebig received his education at the University of Karlsruhe and the University of Berlin, from which he graduated in civil engineering. He came to the United States in 1882, and after six years of engineering experience with railroad and mining companies, he entered private practice in California. In 1900, he established his office in Los Angeles where the firm began to expand with the rapidly growing economy of the West. It never has closed its doors since 1910.

Influenced by Father's Distinguished Career

Adolf H. Koebig, Jr. was profoundly influenced by his father, and, unlike his two brothers who chose medicine and banking, decided early on a career in engineering. After completing his formal education he struck out on his own to gain a well rounded background of practical experience. He first went to work as a field engineer for the Road Department of Los Angeles County. Later, he became the reinforced concrete engineer for the Building Department of the City of Los Angeles.

On occasions, young Koebig had done some engineering work for his father, but he did not become permanently associated with him until 1910. His work with the elder Koebig was not very remunerative, and he finally proposed to his father that he be given an interest in the business. After considerable reflection, his father agreed to give him a 5 percent interest in the business and the firm of Koebig and Koebig was established. The professional career of Adolf H. Koebig, Jr. was launched as a 95 to 5 percent participation in the family firm's profits. With the increase in responsibilities and the growing prestige created by his own engineering accomplishments, the junior Koebig was given an increasingly larger share of the business. In the late

'30s the father became less active, and in 1944 he passed away at the age of 92.

Early Consultants Face Competition

Looking back to the beginning of his colorful career, Adolf Koebig, Jr. remembers three distinct sources of competition encountered by the engineer in private practice on the West Coast. He points out that up to 1912, consultants were usually engineers connected with large corporations whose services were available privately to others by consent of their full-time employers. About 1918, professors of engineering began to make their services available to industry, and though they continue this practice today it does not represent as large a proportion of the consulting work as it did in the past. Then in 1930, and for a period of approximately seven years, eastern engineering firms invaded the West Coast.

This latter period also marked the introduction of competitive bidding for engineering jobs, and Koebig, witnessing its evils, resolved that something should be done to root out the practice. He has been in the forefront of activities seeking to improve engineering standards of performance and ethical practices ever since. As one of the founders of the Consulting Engineers Association of California, he has carried on his crusade within the Association as well as in other organizations, such as the American Society of Civil Engineers, American Water Works Association, California Sewage and Industrial Wastes Association, American Arbitration Association, and Los Angeles Chamber of Commerce, in which he has been active.

Koebig believes that fee bidding again is plaguing the profession, in spite of a relatively large volume of engineering work on the boards and a substantial amount of projected work for the future. He voices a warning that some constructive action should be taken to stop the trend. Younger engineers should be educated more thoroughly in ethical practices and specifically, the evils of bidding. In fact, some of the older firms, who should know better, need to be reminded that this practice can lead only to demoralization of the profession.

Water Supply First Major Activity

Reflecting on the past 50 years, Koebig divides the history of his firm into three major phases. From 1910 to approximately 1925, projects were predominantly in water supply. The growth and development of California during this period was dependent upon water, and it was the foresight of prominent engineers that insured adequate supplies of water for population and industrial growth. A great deal of ground water development was handled by the firm in this era. Clients included many



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individual power and irrigation companies, which subsequently have been integrated into the Pacific Gas and Electric Company and the Southern California Edison Company.

This was an interesting period in the firm's history, for it involved not only the problems of production, storage, and distribution of water, but also the legal and social problems which typify such developments in water short areas. Because water was needed for power development, irrigation, and domestic use, the engineering work involved was varied and called for a high level of skill.

The nature of these early projects forced Adolf Koebig, Jr. and his father into appearances as expert engineering witnesses in litigation and into detailed presentations of proposals to prospective clients, particularly city councils and other governmental bodies. It has been said that Koebig, Sr. would have made an excellent lawyer, for his persistent, forceful, and logical presentations of engineering evidence in litigation cases were widely respected.

Sewage Work Added

The second principal phase of the company's development extended from approximately 1925 to 1940. During this period, in addition to water works, the design of sewage collection and treatment facilities began to develop. This transition was typical of the era, since many major water distribution systems had been completed, and the cities of Southern California were expanding to the point where sewage disposal had become a major problem. Adolf Koebig, Sr. became acquainted with Karl Imhoff of Essen, Germany, and early in his practice in the sanitary engineering field had introduced the Imhoff tank for digestion of sewage.

It was at this time that Adolf Koebig, Jr. became extremely active in the development of improved methods of sewage treatment, including multistage digestion of sewage sludge. He pioneered many of the treatment processes now in general use. Representative clients during this period included the cities of Wasco, Tehachapi, Brawley, El Segundo, Covina, Imperial, San Jacinto, El Centro, Bishop, Culver City, and a number of the sewer districts in Los Angeles County.

The Covina plant was one of the first sewage treatment systems in which the effluent was reclaimed and used for recharging the underground water table. This plant is no longer in existence since the Los Angeles County Sanitation District now serves the area. However, it was considered a major advance in sewage treatment, for it illustrated the high degree of sewage purification which could be attained to meet the demands for conservation of water. The Wasco and Fresno treatment plants, designed for economical reclamation

of effluent for irrigation use, were additional landmarks in water conservation.

Diversification

The third phase of the firm's development extends from approximately 1940 to date, and it reflects the expansion of the entire economy during this period. Initially, Koebig and Koebig was organized as a partnership with relatively limited fields of practice. During and since World War II, the firm has expanded to include all phases of engineering design, and an architectural department has been added. Work during this later period, in addition to many major sewerage and water projects, consisted of airfield design, engineering and architectural design of complete military installations, road work, electrical distribution systems, missile facilities, and engineering assignments for the Atomic Energy Commission.

Through the years, Koebig has developed an organization flexible enough to keep pace with the rapidly changing design criteria necessary for these new undertakings. Particularly noteworthy has been the development of new approaches to water supply and the disposal of wastes. Missile facilities, for example, require large amounts of water at high pressures and high flow, and the disposal of radioactive wastes is fast becoming one of the major problems of our times.

From Partnership to Corporation

The philosophy of business conduct and operation established by Koebig Sr. continues today in the present organization of the company. It is still a family operation, even though, in order to assure a self-perpetuating organization, Koebig and Koebig became incorporated in 1948. But the "family" now includes not only Koebig, but his immediate associates in the firm. Many of these men have worked with both Koebig Jr. and Sr.

Stock in the corporation is held by Koebig and his close associates under a plan that will not permit it to pass into the hands of the general public. In the event of the death or departure of any of the principals in the firm, the stock returns to the corporation for redistribution to the remaining principals. Stock compensation is provided for in the agreement under which it is issued. This arrangement is designed to hold talented principals and is not set up to attract outside capital. The philosophy behind the company's operations has been developed to provide a balance of high quality engineering through the selection of people with the essential talents, and to pursue the proper type of business development under the highest standards of the engineering profession. Approximately 130 people are employed by the firm. ▲▲



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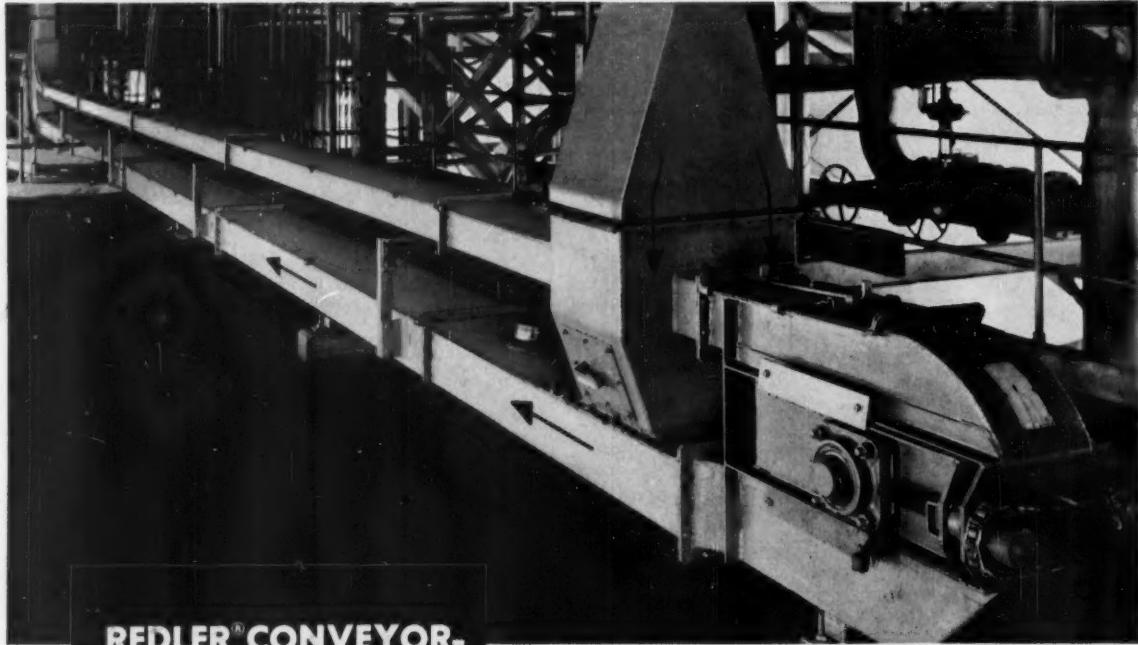
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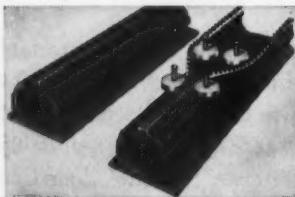
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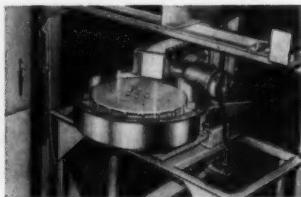
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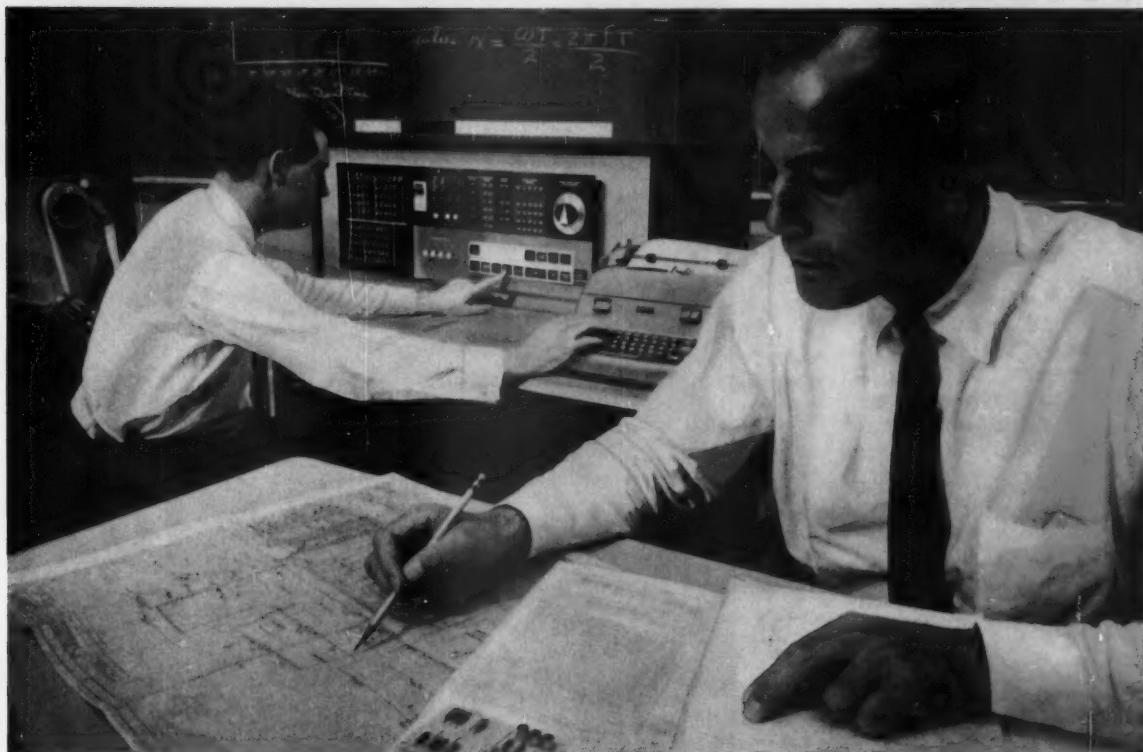
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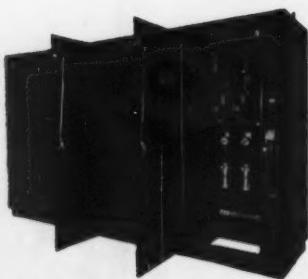
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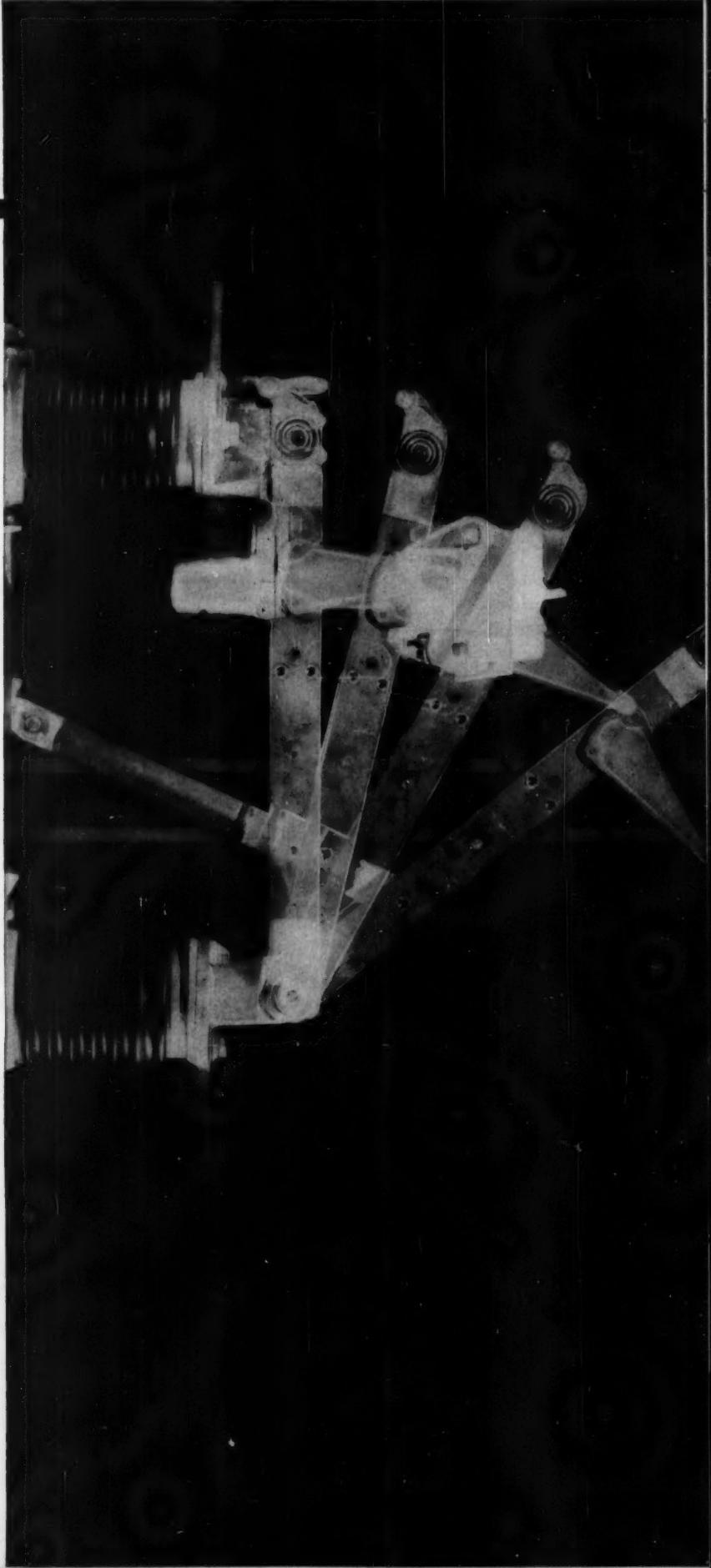
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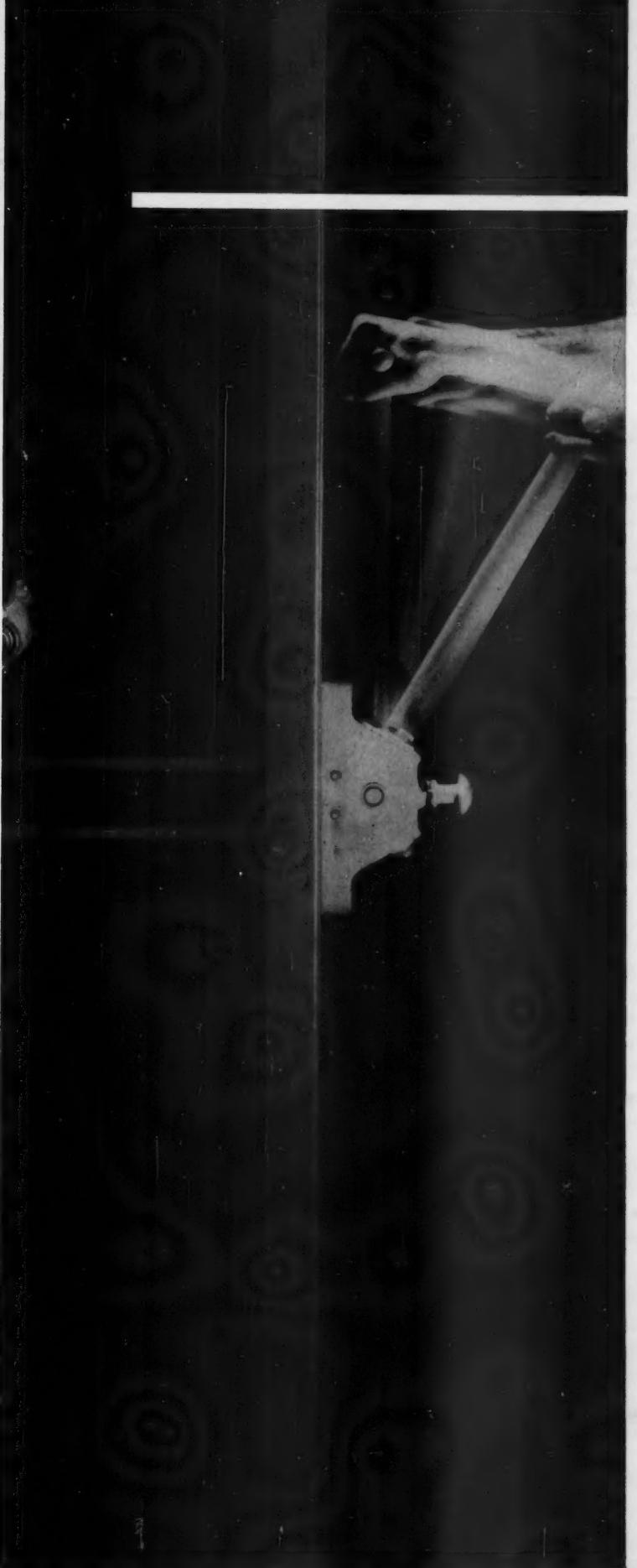
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No danger to equipment—no danger to operator even if he closes load interrupter switch on the heaviest faults. S&C's new line of metalclad switchgear is rated as high as 44,500 amps fault closing, 500 mva short-circuit interrupting at 14.4 kv. And at 4.16 kv, the corresponding ratings are 60,000 amps, 250 mva!

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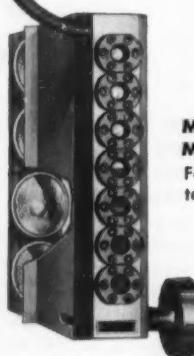
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For boiler pressures up to
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For a trouble-free gauge that makes reading of water level sure and easy
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Note These Features:

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- Ports are 1½" diameter on MP 1050 Gauge.
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- "Hi-Lite" Illuminator — More visibility with less cleaning.

The individual glass disks provide inherent thermal stability not obtained in the continuous vision gauge which requires the long glass and mica. Thermal stress is much less troublesome and damaging. Small mica disks cost less, and are not subject to wrinkling or cracking. Any port — glass, gasket and mica — may be replaced in minutes without removing the gauge from the boiler. Torquing operations are much less critical, and warm-up period is minutes instead of hours.

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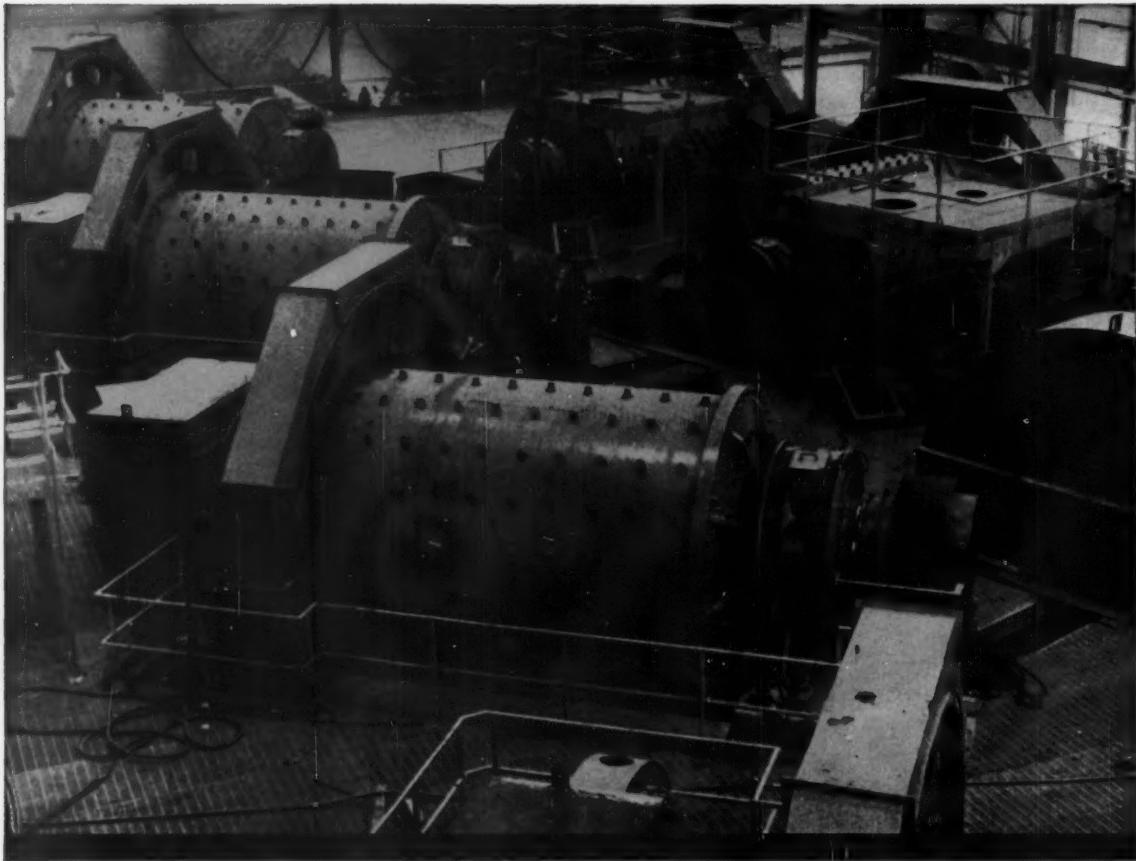
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Readers' Comment

Wonders About Woodcuts

Sir:

I have often wondered who was responsible for the profusion of elaborate and expressive cartoons which enliven your fine publication. Could it be Philip Reed, or is it someone else?

V. G. Thompson
Hudgins, Thompson, Ball
and Associates
Oklahoma City, Oklahoma

PHILIP REED IT IS, THE EMINENT WOODCUT ARTIST WHOSE RECENT ILLUSTRATED EDITION OF JAMES THURBER'S *Many Moons* WAS SELECTED AS ONE OF THE "FIFTY BOOKS OF THE YEAR."

Advisory Disaster Service

Sir:

The following is information concerning the activities of the Consulting Engineering Functional Group, Idaho Society of Professional Engineers, Inc., which is affiliated with the National Society of Professional Engineers, Inc.

At the regular monthly meeting of the Consulting Engineering Functional Group, ISPE, in December 1959, a committee of consulting engineers reported on the formation of a disaster service to be known as the "Consulting Engineers Advisory Service." An alert committee is to be appointed comprising four members throughout

the State of Idaho. The members of the alert committee will be called upon in the event of a disaster in Idaho, who shall then put into motion such engineering services as may be required for the particular disaster. The Consulting Engineers Functional Group shall make an assessment on the membership, following the conclusion of service, to repay the actual and necessary expenses of the engineers who served on the disaster assignment. The time of service is to continue no longer than is necessary for constituted authorities to organize and relieve the volunteer engineers. The aid is to be advisory and in no case intended to supersede competent police, regulatory, or administrative officials.

The over-all head of the alert committee is to be the State Chairman of the Consulting Engineers Functional Group. The purpose of the volunteer services is to aid in the protection of health, life, and property until the initial crisis has passed, and is not intended to care for restoration, after effects, or subsequent remedial actions for which engineers should be engaged, as needed, in normal fashion.

S. M. Barton, Secretary-Treasurer
Idaho Society of Professional
Engineers, Inc.
Consulting Engineers
Functional Group

From FIDIC's Secretary

Sir:

[I understand] that you had a number of not too unfavorable comments on my cover story. I received some too, mostly agreeing to what my co-Europeans think the position is from our point of view. I wonder what you Americans think of my outlook. I tried to contribute to the existing mutual goodwill.

Promoting FIDIC with your countrymen is worth an effort. I think this international organization of free professional men is worth doing some work for. I believe, however, that promoting ideals is a slow process which asks perseverance from its adherents. There is an old saying here stating that towing must be done cautiously otherwise the cable snaps. Wise old seaman! That is why all of you live in America at all. No ocean steamers and aircraft in those days.

Well, thank you very much for giving me an opportunity to talk.

Ir. H. Rusting, Secretary
International Federation of
Consulting Engineers (FIDIC)
The Hague, The Netherlands

The Meaning of "Consulting"

Sir:

From your "Tranquil Tower" (January 1960) you take a look at the designation "consulting engineer." Your comments on the definition put out by the Consulting Engineers Council are entirely in order. But why not go further — down to the real meaning of words?

Webster's Collegiate Dictionary, 5th Edition, contains the following: "Con-sult'ing, adj. Designating one called in conference regarding some case; as a consulting physician."

Actually, there are very few men in engineering practice who can qualify as consulting engineers under this definition. This correspondent has known only two. Probably all engineers in private practice do some purely consulting work, but they also do design and supervision work. It would be more accurate to call them "designing and consulting engineers" since every project requires both services. It would be interesting to know how many state boards of regis-

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tion recognize the term "consulting" as applied to engineering. Texas does not.

As for employees of corporations, either collegiate or commercial, or of governmental units, serving in a consulting capacity, there should be only one criterion to apply; would there be a conflict of interests. It would be folly to rule out all highly trained technical men as consultants simply because they were salaried. But it would be manifestly improper for such a person to enter into consultation which might affect his or his employer's financial welfare.

Frank W. Chappell
Consulting & Designing Engineer
Dallas, Texas

Wants to Join a Group

Sir:

Having crusaded alone, more or less successfully depending on the goal, over a period of some years, we have arrived at a point of hesitation, wondering whether it might not be better to organize or to join a group of single purpose, capable of fielding a force of sufficient mass to present a front of bulk, as well as logic.

To assist in inquiry, we request that you advise us the address of the national office of the American Institute of Consulting Engineers and the Consulting Engineers Council.

If you have any information on local chapters of the above organizations in our locality, we would greatly appreciate your sending it along to us.

Thank you very much. You have an excellent magazine.

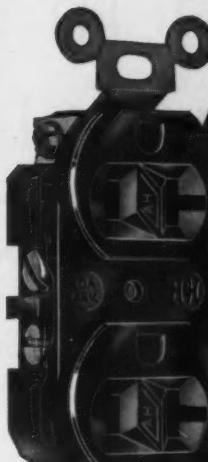
Daniel E. Gaffney
Waterman, Fuge & Associates, Inc.
Fort Atkinson, Wisconsin

• FOR OTHERS WHO FEEL THE SAME, THE ADDRESSES OF THESE GROUPS ARE — AMERICAN INSTITUTE OF CONSULTING ENGINEERS, 33 WEST 39TH STREET, NEW YORK 18, N.Y.; CONSULTING ENGINEERS COUNCIL, 326 REISCH BUILDING, SPRINGFIELD, ILLINOIS.

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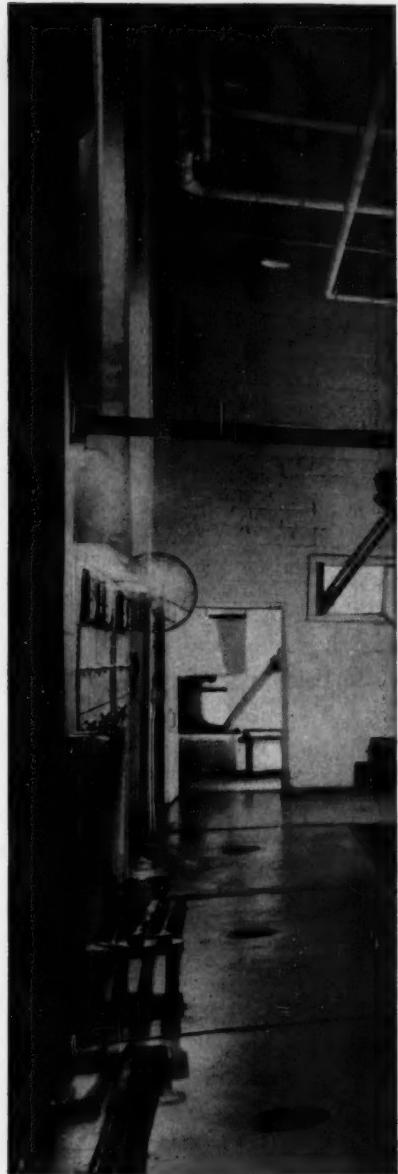
Today, when the annual cost of fuel often equals the original cost of the boilers, you should know that bituminous coal is the lowest cost fuel in most industrial areas. And modern coal-burning equipment gives you 15% to 50% more steam per dollar, while automatic operation trims labor costs and eliminates smoke problems. What's more, tremendous coal reserves and mechanized mining procedures assure you a constantly plentiful supply of coal at stable prices.

TECHNICAL ADVISORY SERVICE

All companies planning a new power plant, or the remodeling of a present one, should consult an engineering firm on its design and construction. As a matter of fact, every Bituminous Coal Institute advertisement advises its readers to take this step. When you have such a project, our Engineering Staff will be glad to assist you in your fuel cost survey with any coal information you may require.

BITUMINOUS COAL INSTITUTE
Department CE-02, Southern Building, Washington 5, D.C.

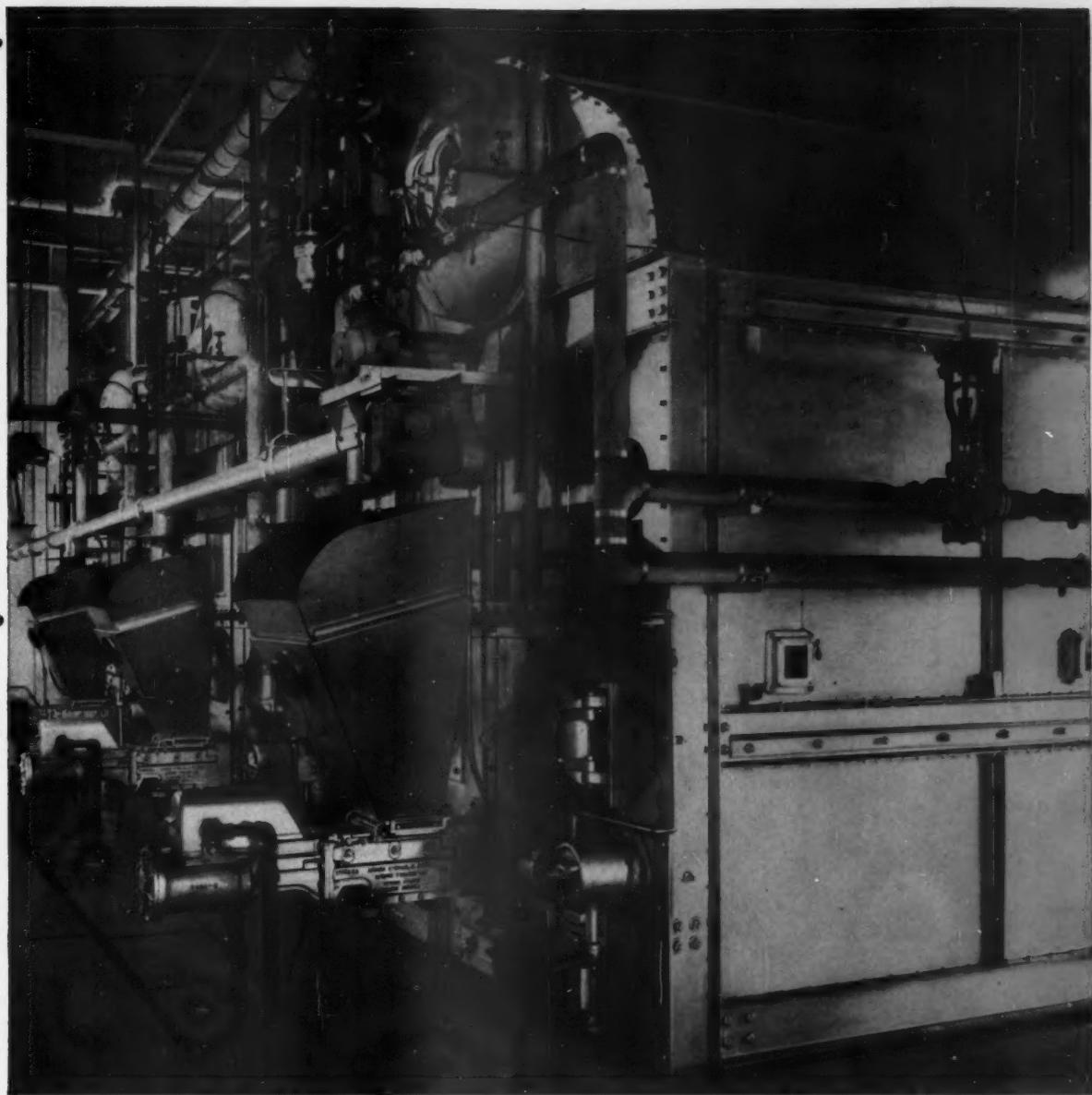
See our listing in Sweet's Files: A-30J/Bi; PE-4a/Bi; IC-18b/Bi



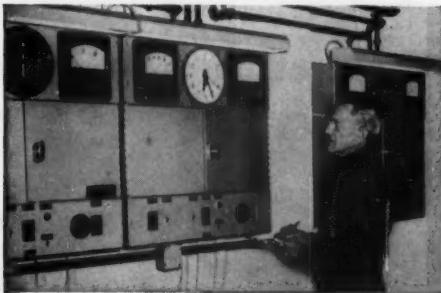
Coal is discharged into bin and gravity fed into hopper box, then moved by inclined screw conveyor into horizontal screw conveyor leading to stoker hoppers and boilers. Boilers are Keeler 10,000 lb/hr "CP" type units, 150 psi. Coal handling system by Auburn Foundry Company.



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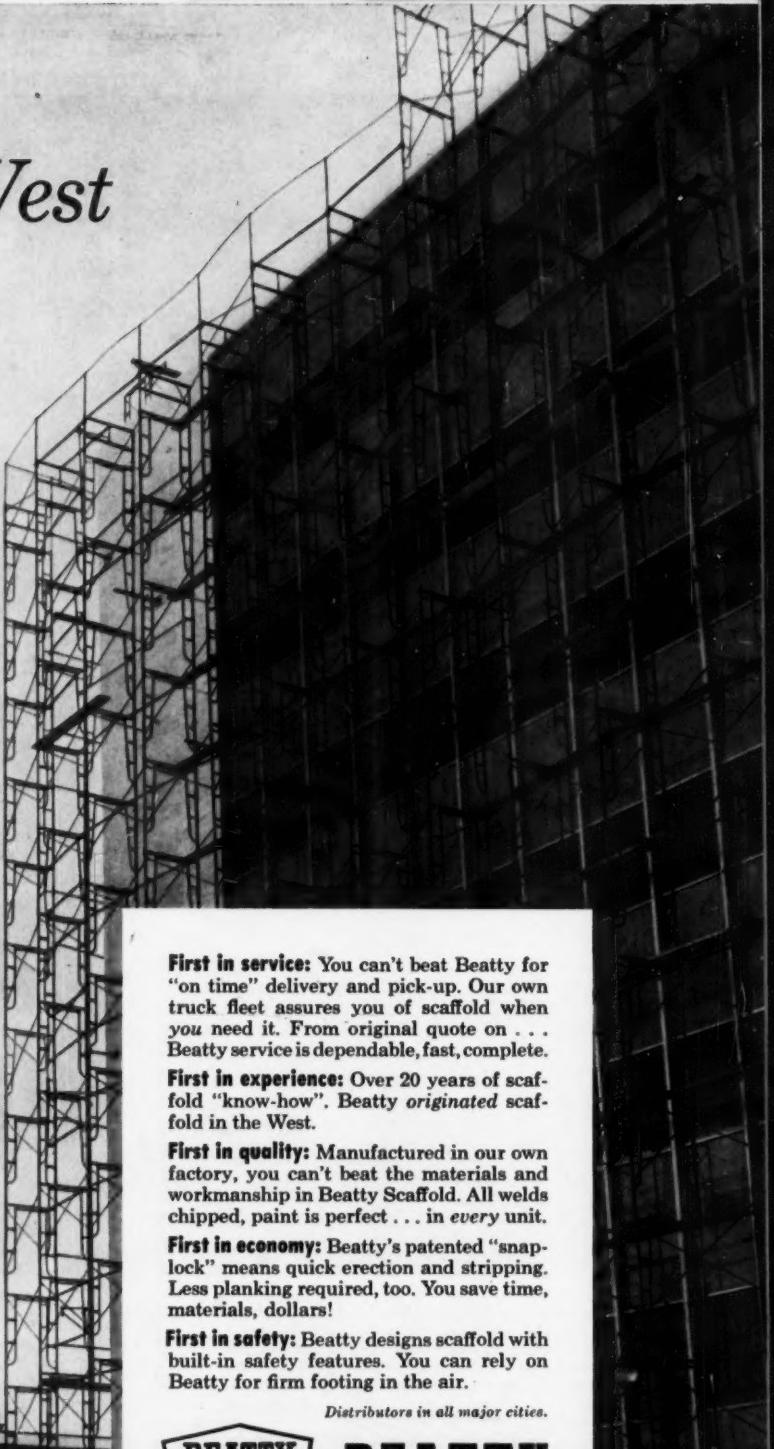
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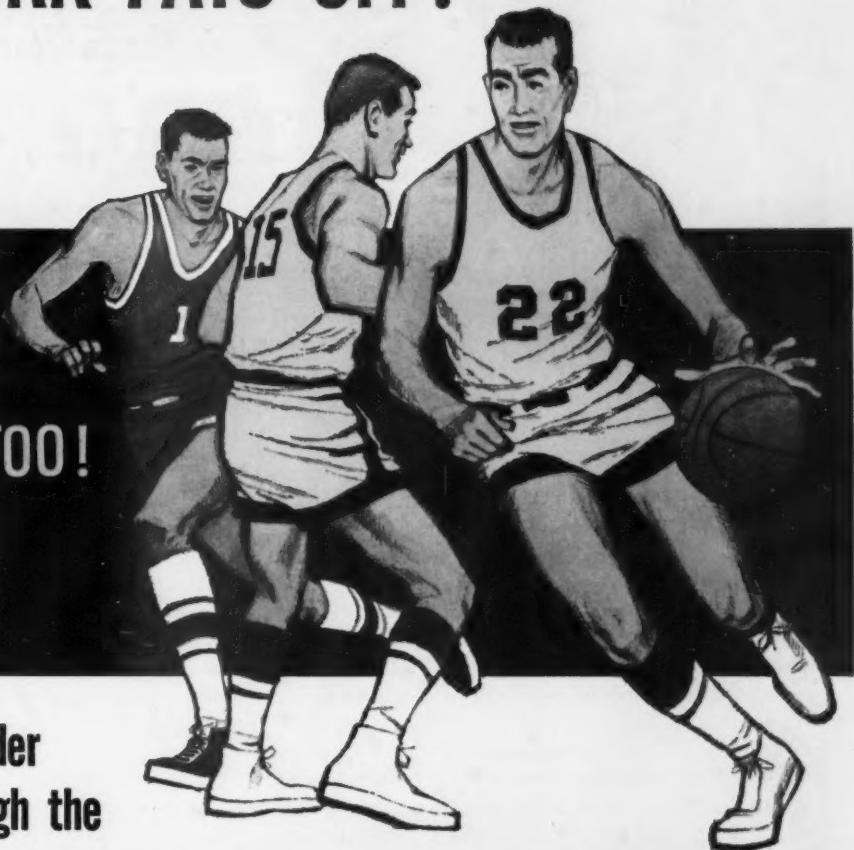
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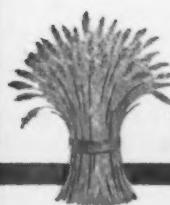


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From the Editor's

Tranquil Tower

This is a consulting engineer?

IN THIS COLUMN last month we pointed out the need for a definition of "consulting engineer," and since that time we have received considerable comment from engineers in several parts of the country. If there is not yet a definition that will satisfy all, we have come up with one that seems to have merit, and we offer it as a starting point. It should be noted that we, and all with whom we have discussed this, are conscious of the fact that *consulting*, as an adjective, is misleading if one thinks of it as describing "one who consults." We must understand that today a consulting engineer no more confines his activities to consultation than a drug store limits its sales to drugs. Most consulting engineers are engaged in design and specification for some type of construction. Perhaps it is unfortunate that some other term more truly descriptive was not hit upon many years ago, but it was not, and so there we have it! We cannot hope now to change to "design engineer," or "practicing engineer," or "Congineer," or anything else. Consulting engineer it is, and that it will stay.

Our task, then, is not to select some new appellation but to define properly the one that is accepted in contemporary English and American usage. (And French usage, as well — *Ingenieur-Conseil*.)

The definition we offer is in two parts. The first part is simple and direct and should be considered the basic formula. The second part is an explanation of some of the terms used in the formula — terms that may not always mean the same to all people.

Here is the definition:

A consulting engineer is an engineer legally engaged in the private practice of engineering and personally responsible for his engineering work.

¶ To be *legally* engaged in private practice, an engineer must be licensed, registered, or otherwise qualified by law or established custom to practice engineering.

¶ To be *engaged in private practice*, an engineer, or any firm or corporation through which he practices, must offer engineering services as a vocation and not as an activity incidental to some other business or profession.

¶ To be *personally responsible* for his engineering work, an engineer, if he practices through a firm or corporation, must be able to act for his firm or corporation and must be legally responsible for its acts.

We believe this is a good definition. Though it is possible that it contains some flaws in language, logic, or law, it seems to cover the principal points of contention.

It should be noted that the definition requires registration by law or qualification by established custom. The reason for permitting qualification by established custom is to make this definition international. Many nations do not provide for registration by law. In Britain, for example, examinations are given not by the state but by one of the Institutions (corresponding to our Founder Societies), and the right to offer services to the public is covered in the rules and regulations of these organizations rather than in the law of the land. Other countries have other customs or traditions, and a consulting engineer cannot be required to register where there are no registration laws.

More controversial is the interpretation of the phrase "engaged in private practice," and here there has been some justifiable confusion. Part of this confusion can be removed by a clearer understanding



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of two often misunderstood semantic equations:

Professional Engineer = Attorney
Consulting Engineer = Attorney-in-Private Practice

Applying these equations we find, for example, that just as a law professor who takes an occasional case is an attorney, so an engineering professor (a registered engineer), who does some outside design work is a professional engineer. But the engineering professor is not a consulting engineer and the law professor is not an attorney-in-private practice. This same equation can be applied to the engineer in industry or commerce who does occasional consulting work and the engineer in government who takes on some design work of his own. They are, if registered, professional engineers, but they are not consulting engineers. Similarly, employee attorneys are surely attorneys, but they are not attorneys-in-private practice.

With this background, we can apply, with some assurance the pertinent test of incidental activity. Here we have not only the black and the white but a great grey area. A manufacturer's representative who offers to undertake engineering work, either "free" or for a full fee, obviously is not a consulting engineer, for he is doing the engineering as an activity incidental to the sale of his products. If he is registered and if he charges a full fee, he may

be a perfectly ethical professional engineer, but he is not a consulting engineer. He then is a professional engineer doing design work for a customer.

At the opposite extreme is the engineer in private practice who has a financial interest in a local bowling alley. The bowling alley is incidental to his engineering practice, and we can assume that he invested in the bowling alley simply because he liked bowling. There is no conflict of interest and no confusion as to his true vocation. He is a consulting engineer.

The grey area, however, is broad. In this are the constructors who do engineering and also contract for construction. According to this definition, the managers of the engineering department of such a firm or corporation could be consulting engineers if they proved that they were practicing engineering as a vocation and not an activity incidental to the work of the construction department. It would seem that such engineers, who otherwise fulfilled the qualifications of the definition, might properly call themselves consulting engineers if they charged full fees for their engineering and did not in any way conceal their engineering charges in the charges for construction, and if they regularly offered their engineering services separately from their construction work. If, however, engineering is offered merely as an inducement,

... to control water level at Long Sault Dam, St. Lawrence Power Project



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IN HIGH HUMIDITY AND
CONTAMINATED AIR!**

Integral casting of POLESTIGLAS (right) assures uniform bus insulation and eliminates hand-wrapped bonds and offsets. Insulation is bonded to the bus bar to give void-free construction resulting in low corona loss.

Po-les-ti-glas...a cast or molded glass reinforced polyester...Provides superior insulation for metal-clad switchgear...Licks "problem" installations too tough for conventional insulation...Proves best insulation for use in areas of high humidity and contaminated atmosphere. **TEST RESULTS SHOW:** ■ Superior resistance to tracking ■ Reduced moisture absorption ■ Low, stable power

factor in high humidity ■ Greater flame retardance ■ Low corona loss ■ High dielectric and impact strength. POLESTIGLAS...another engineering achievement in Federal Pacific's program to better serve utilities and industry. Write for Bulletin 6025, Federal Pacific Electric Company, General Offices: Department 374, Newark 1, New Jersey. *Trademark of Federal Pacific Electric Company

FPE FEDERAL PACIFIC ELECTRIC COMPANY
The Best in Electrical Distribution and Control Equipment

as is done by many contractors, then the men undertaking this engineering are not consulting engineers. They are professional engineers in the construction business.

Unfortunately, it is not easy to determine the degree of independence of a contractor's engineering department. The judgment must be up to those to whom the decision has importance — the admissions committee of a consulting engineers' association, or the person or persons at the World Bank, for example, who must approve the engineers selected for a project for which a loan is being made. But no judgment can be made in this grey area until the facts are presented for a specific organization.

It is conceivable that engineering and manufacturing could be done by the same firm, and the engineers heading the engineering department might legitimately call themselves consulting engineers. But this would be rare, and it would have to be clearly proven that the manufacturing was incidental and in no way stood in conflict with the independence of the engineering services offered. It would have to be shown that the camel had made it through the eye of the needle.

The last of the three parts of the explanation has to do with personal responsibility. There is no problem if the practice is under sole ownership or

is a partnership. In that type of firm, under this definition, the owner, or the partners, are consulting engineers. All other engineers in the office properly would be termed engineers working for a firm of consulting engineers.

When consulting engineers practice through a corporation, it is more difficult to decide who is a consulting engineer, for all are employees. This definition states that only those engineers who can act for the corporation and are legally responsible for its acts are properly known as consulting engineers. This would mean all the officers and directors of the company, plus any other employees legally authorized to act in the name of the company, could call themselves consulting engineers if otherwise qualified. Just who is and who is not responsible for the act of a corporation varies from state to state and from country to country, but there should be no serious difficulty in understanding the intent of this part of the explanation.

There are other particular points of disagreement, and many engineers will not agree even with the intent of this definition and its accompanying explanations. It is a start. We are adopting it until someone comes along with a better one. We will not be stubborn. We can make changes as fast as a typesetter can operate his machine — if the changes are required. □

GLOBE SAFE-GARD EXPANDED METAL PARTITIONS with exclusive **QUIK-ERECT** patented fittings

...will answer all your enclosure problems



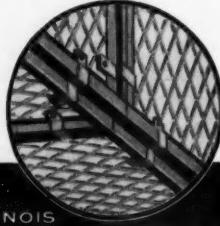
Here is the new, easier, simpler method of guarding conveyors and machines and for all in-plant partitioning. Shipped READY for erection, no cutting, drilling or welding required . . . these interchangeable expanded metal panels provide greater safety, cut overall costs, cover a wider range of use and require 85% less storage space.

EXCLUSIVE QUIK-ERECT SECTION CLIPS save much of the erection time formerly required. Proven successful in hundreds of installations, these Safe-Gard panels are of welded construction, give longer life, are more rigid and stronger than wire, will not ravel or fray.

Note enlarged detail showing **SAFE-GARD** Quik-Erect Clips securely joining the interchangeable panels.

Write today for more details or call your Globe (Grip-Strut) Distributor. Distributors in all principal cities, listed under "Grating" in your phone book.

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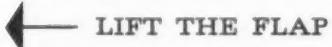


New from American-Standard
Industrial Division

Air-Lift[†] for Industrial Plants

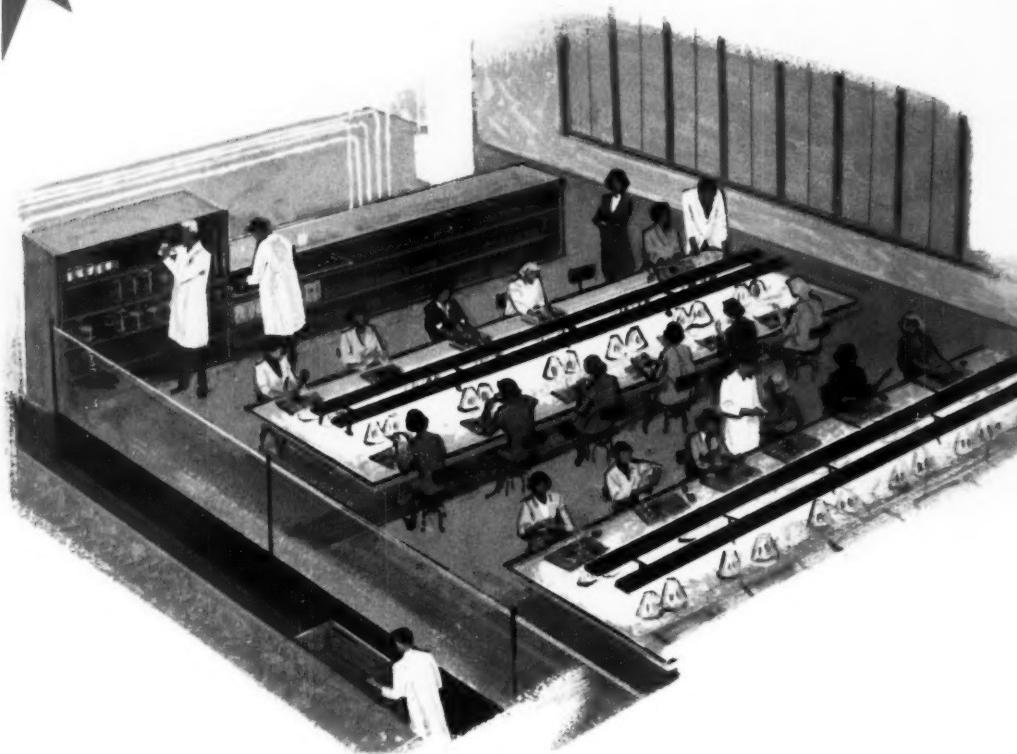
Air-Lift is a new concept of coordinated products and services from American-Standard Industrial Division. Its purpose is to help you lift the productivity and profitability of your business through better control of implant environment. Air-Lift offers you one-source responsibility for quality and performance in air-conditioning, air-handling, heating, and air-pollution-control equipment that is designed, engineered, and manufactured to work together.

To see how Air-Lift can benefit your plant . . .



†Service-mark of American-Standard

American-Standard Industrial Division AIR-LIFT IN ACTION



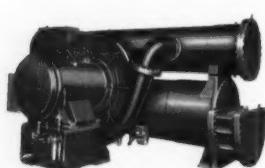
Greater efficiency in
MANUFACTURING

It takes an exper



Select by the piece, buy by the package

AIR CONDITIONING



Centrifugal refrigeration
units for central systems.



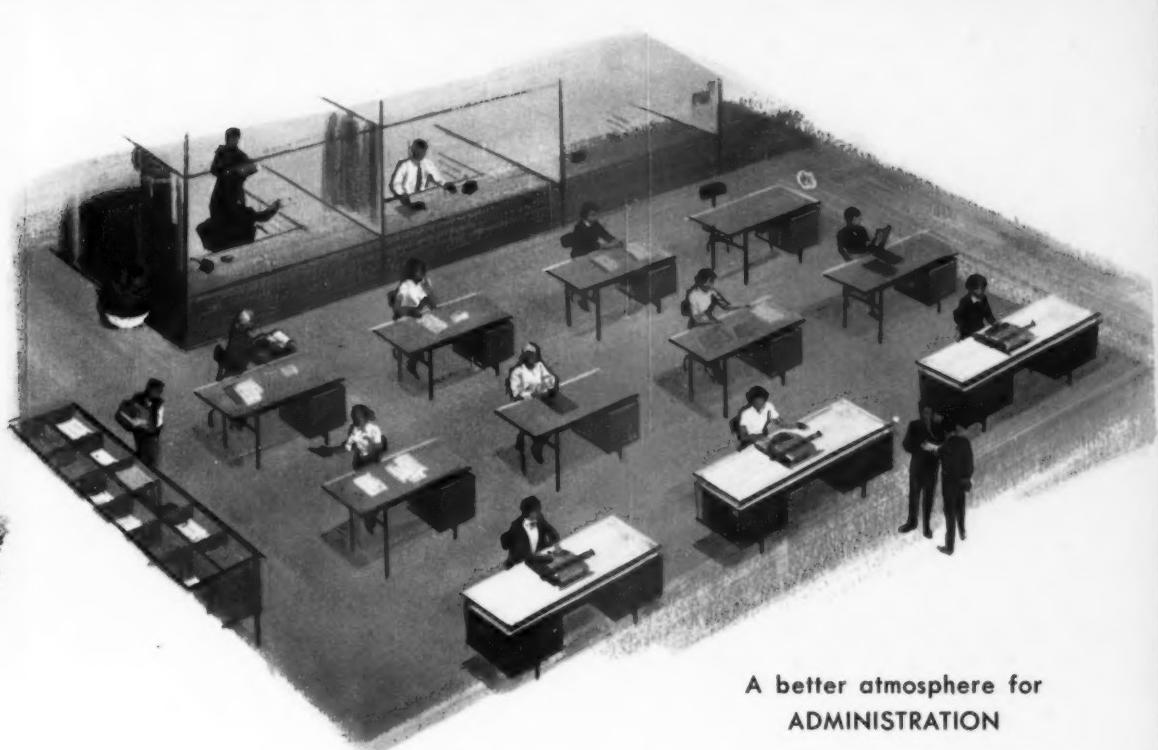
Central-station units for
plants and office buildings.



Centrifugal fans for supply
or exhaust in duct systems.



Industrial fans for
air, gases, and m



A better atmosphere for
ADMINISTRATION

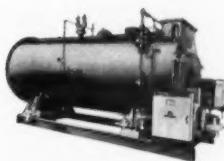
Experienced team to make indoor climate behave

Here's how we fit in . . .

American-Standard Industrial Division product specialists work right along with your plant operating managers, your architect, consulting engineer, and contractor. They have the equipment to do the most efficient job in every phase of implant environment control . . . from air-conditioning, heating, makeup air and

exhaust to dust collection and process air handling. And they have the experience and know-how to help you from the planning stage to final installation. Co-ordinated products and services give you a better atmosphere for administration, improve efficiency in manufacturing . . . give your entire plant an AIR-LIFT.

HEATING



Boilers and package units for heat and process steam.



Vertical and horizontal unit heaters for steam, hot water.

AIR POLLUTION CONTROL



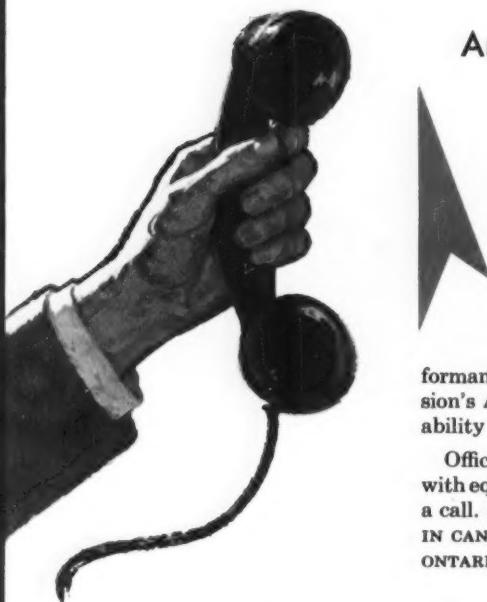
Dust collectors tailored to the type and amount of dust.



Fly ash collectors to control emission and recover fly ash.

One-source responsibility

The heart of American-Standard Industrial Division's Air-Lift Service



Better control of implant environment requires many different kinds of equipment . . . equipment which must work together as a system.

By selecting *all* the major components from American-Standard* Industrial Division, you draw from the combined American Blower, Ross, and Kewanee product lines. You get equipment designed, engineered, and manufactured to work together. You get *one-source* responsibility for quality and performance—an important benefit of American-Standard Industrial Division's Air-Lift Service. Air-Lift helps you lift the productivity and profitability of your business.

Offices in all principal cities are staffed by product specialists to help you with equipment selection and on-the-job problems. Give the office near you a call. AMERICAN-STANDARD INDUSTRIAL DIVISION, DETROIT 32, MICHIGAN. IN CANADA: AMERICAN-STANDARD PRODUCTS (CANADA) LIMITED, TORONTO, ONTARIO. EXPORT DIVISION, AMERICAN-STANDARD, NEW YORK CITY.

Products designed, engineered, and manufactured to work together

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Centrifugal refrigerating machines
Central station units • Fancoil units
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• Package water chillers
Multi-zone air conditioners
Sprayed coil dehumidifiers • Heating
and cooling coils • Air washers

AIR HANDLING

Industrial fans with wheel types
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and shavings • Centrifugal, propeller,
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fans • Utility sets • Power roof
ventilators • Centrifugal compressors
• Specialized fans, blowers

HEATING

Firebox, scotch-type steel boilers
and package units for heat, process
steam • Vertical and horizontal
unit heaters for steam or hot water
Heavy-duty heating coils • Industrial
unit heaters • Heating and
ventilating units • Cabinet heaters

AIR POLLUTION CONTROL

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centrifugal dust collectors • Dis-
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Gyrole Fluid Drives for stepless,
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sizes, 1 hp thru 12,000 hp • All
provide extremely smooth pickup
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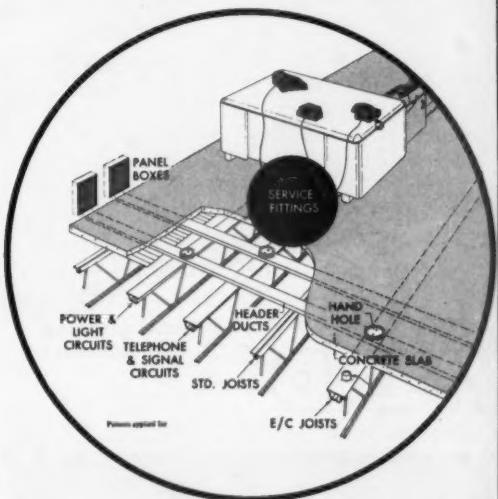
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**THE NEWS IN
UNDERFLOOR ELECTRIFICATION
IS THE SAVING OFFERED
BY CECO'S E/C JOIST SYSTEM**



Whenever desks are moved, electrical outlets can be installed anywhere along the E/C Joists to service the new positions. Electrical, telephone and signal wires are run down through the floor at the service fittings, through the top chord of the E/C Joist, into the header ducts and on to the service panel boxes.



TOTAL MANUFACTURING FOR THE BUILDING INDUSTRY FROM RAW TO FINISHED PRODUCTS

When a method of construction offers quality at a cost lower than any competing system, that's a combination hard to beat. Add to that — practicality plus design that satisfies the future . . . then you can specify with confidence. Such is Ceco's E/C Joist system of underfloor electrification. Savings are realized because Ceco's E/C Joists do two jobs: 1 — provide raceways for underfloor electrification; 2 — carry the floor load. Now any building "can afford" underfloor electrification. On your next job specify the Ceco E/C Joist system. Send for the facts now. Mail the handy coupon today. Ceco Steel Products Corporation. Sales offices, warehouses and fabricating plants in principal cities. General offices: 5601 West 26th Street, Chicago 50, Illinois.



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SUPERIOR'S rear-mounted DRAFT FAN

offers you 6 IMPORTANT ADVANTAGES

A distinctive and exclusive feature of Superior Water Tube Packaged Boilers is the rear mounting of the forced draft fan. It is a quality feature provided by no other manufacturer. Superior provides this proven and exclusive feature to achieve for its customers the following results which are not possible with any front-mounted-fan design:

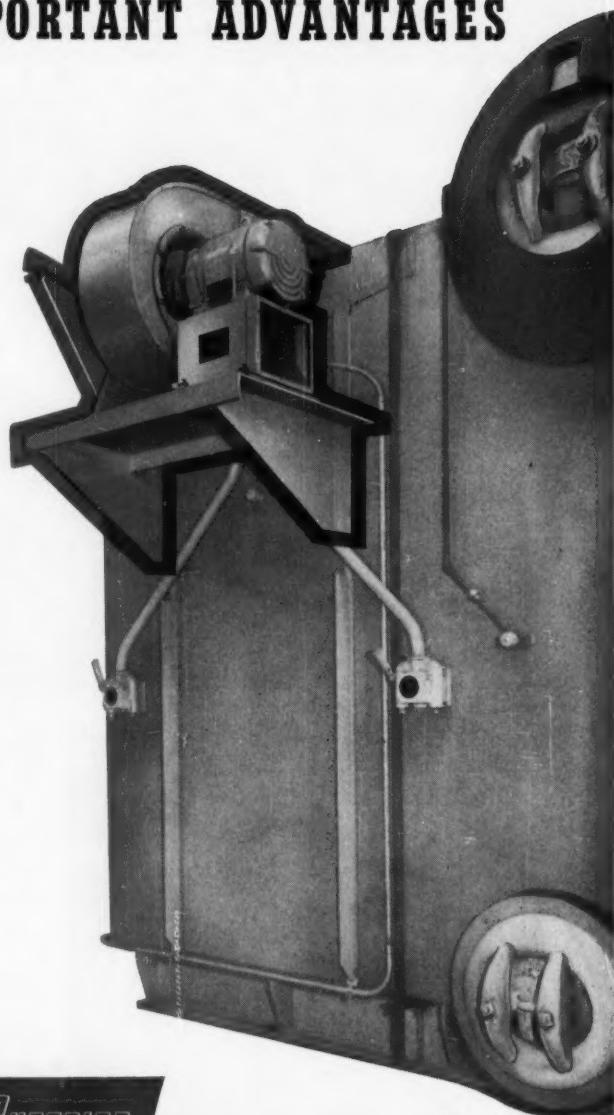
- ① An uncluttered, and much more readily accessible firing front.
- ② Provides quieter operation as a result of lower air velocities between fan discharge and burner register, rather than the remote position of the fan.
- ③ The elimination of flame distortion by the equal distribution of air through the burner register from a plenum chamber.
- ④ The largest capacity units can be shipped with fan mounted in position . . . an integral part of the complete package.
- ⑤ Air-cooled and air-shielded observation ports which protect operator from pressurized furnace, eliminating the aggravation of the commonly used bulls-eye peep opening which is usually dirty and through which little or nothing can be seen.
- ⑥ The added safety of a rear-wall-mounted air-cooled scanner for flame failure protection of steam atomizing burners or for automatic gas firing with continuous gas pilot.

Built, tested and shipped as complete packages, with integral firing equipment, draft fan, and controls to suit your operations, Type D Superior Water Tube Packaged Boilers provide economical steam production from 11,000 to 61,000 lbs. of steam per hour.

For complete details write for Catalog D-13

Specialists in **PACKAGED BOILERS . . . exclusively**

SUPERIOR COMBUSTION INDUSTRIES, INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.



Note manholes in
both rear drum heads.

SUPERIOR
TYPE D^o

SUPERIOR
PACKAGED BOILERS



**Elementary
Electrical Diagrams**
(page 86)

As W. A. Tripp, of J. G. White Engineering Corporation, points out, the consulting engineer is considerably concerned with elementary electrical diagrams, for he receives them from equipment manufacturers and he produces many of his own as he develops plant processes. There are standards that provide a sort of dictionary of the language of elementary diagrams, but there are many choices permitted and there has gradually developed a vernacular that varies throughout the industry. No longer does one engineer always understand the diagrams of another. If this is hard on the electrical engineers, it is torture for all others, and yet these elementary diagrams must be used and understood by mechanicals, civils, and structurals. There is need for a more rational approach. Here, in a comprehensive paper, is one answer. It is worth every engineer's while to give it thoughtful study.

The most generally accepted fee formula for new construction, the percentage of construction cost fee, has come in for its full share of deserved criticism. The problem remains, project after project, year after year. Now, Donald R. Goodkind, of Goodkind & O'Dea has come up with a fine suggestion. It is not a substitute fee formula or a completely new and different approach, but it is a sound and reasonable idea for removing some serious disadvantages of the percentage of construction cost fee. The engineer no longer need depend upon the contractor for the amount of the fee, and this method adopts the advantages of the fixed fee without being burdened by its arbitrary nature. We think Engineer Goodkind has something here, and we recommend its trial by other engineers in private practice. See "Why Let the Low Bidder Fix Your Fee?"

**How to Plan for
Computer Computation**
(page 112)

William T. Gay, Jr., of Fay, Spofford & Thorndike, knows that some consulting engineers dislike the idea of computers, but he insists "they are here to stay." No doubt, he is right, and for most firms of consulting engineers the computer problem is largely one of what type to get and when to get it. Gay has some suggestions based on his firm's experiences, and he goes further to tell about the best way to get a computer staff functioning. He also defends the pleasant idea that firms with computers can justify higher fees.

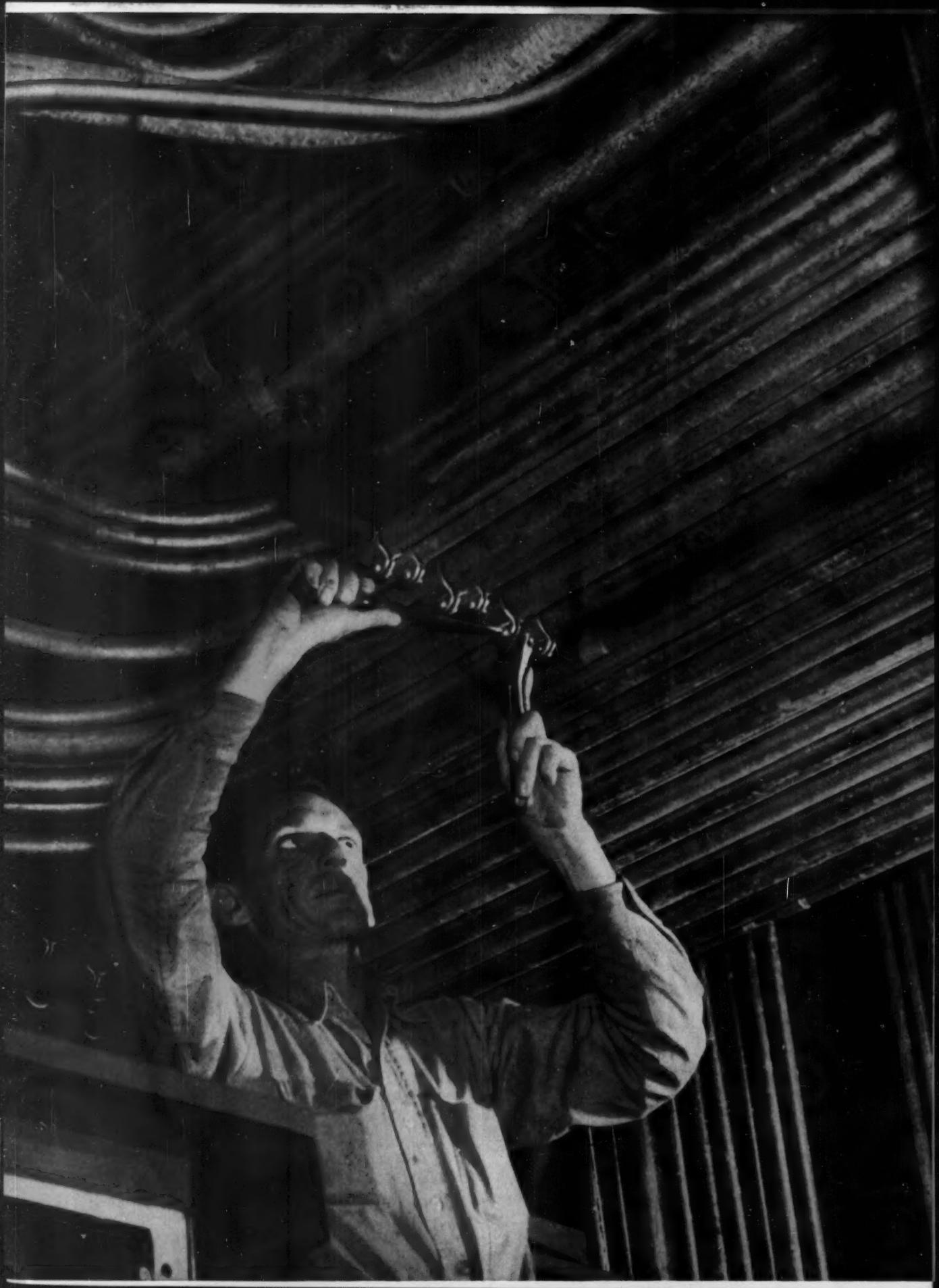
Dr. Lev Zetlin is an ingenious engineer. He has a clever and original means for pretensioning large areas of prestressed pavement. He pours in place inside an abutment constructed in the form of a huge bicycle wheel which permits one spoke to be stressed against another while holding the shape of the rim. Zetlin's rim shapes need not be circles — they often are elongated — but the basic idea is the same. The tensioning cables are stressed against each other within the rim. The idea has much merit, for it permits easier pretensioning for pavements, and pretensioning has distinct advantages over post-tensioning for many applications. See Dr. Zetlin's own description of his system in "A New Way to Pretension Prestressed Pavement."

**Electric
Heating**
(page 102)

Robert L. Whittlesey, consulting engineer of Denver, has established a reputation as an expert in the design of electric heating installations. He feels that there are many instances in which the average consulting engineer overlooks electric heating as a possibility simply because he is so accustomed to limiting his comparisons to gas, oil, or coal, as applied to steam, hot water, or hot air. Yet, according to Whittlesey, electric heating often is as low in cost as any of the others and may offer additional advantages. He includes the heat pump, which is, after all, one method of heating electrically.

**For a Better
Fee System**
(page 115)

**Pretensioned
Prestressed Pavement**
(page 80)



PROBLEM:

Protection from high-voltage failures
due to cable overload.

SOLUTION:

Build up a dependable power system for today and tomorrow—with high-voltage Anaconda Butyl (AB)—insulated Durasheath Cable.

Shutdowns caused by power failures usually entail significant losses; loss of labor during repair time . . . and in some cases, loss of goods in production. This is not to mention cost of repairs, both in labor and in cable. Many such power failures are the result of overloaded circuits—obsolete cables unable to handle the increased loads of today's stepped-up production, or the anticipated needs of tomorrow.

Is your plant's high-voltage electric power system limiting you? Make a careful check of it to find out. Then, if out-of-date or inadequate wiring is a problem, see your Anaconda distributor or the Man from Anaconda—about high-voltage butyl-insulated Anaconda Durasheath.*

High-voltage Anaconda Durasheath (5 kv and up) has been designed to give long life, dependable service. It is insulated with Anaconda Butyl (AB)—resistant to ozone, moisture, heat. Its tough neoprene jacket resists weather, soil conditions, abrasion and mechanical injury.

You can run Anaconda Durasheath from underground to overhead, and into ducts in one continuous run—without splicing. It is light, flexible, easy to handle, economically installed. For further information about Anaconda Durasheath write: Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

*Trademark—Anaconda

Durasheath has Anaconda Butyl (AB) rubber insulation for

- extra high resistance against ozone
- exceptional moisture resistance
- 22% more current-carrying capacity than 70 centigrade insulation

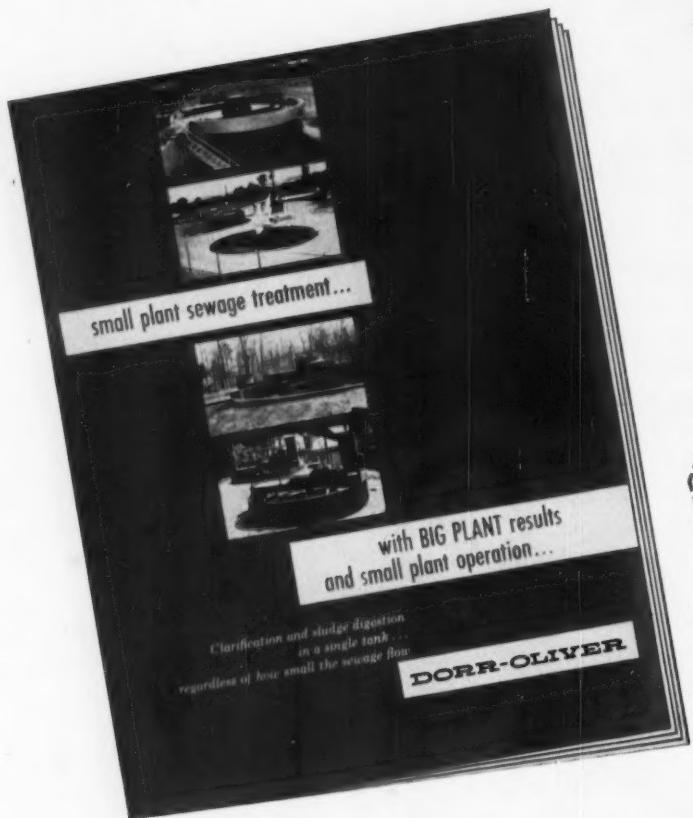
SEE THE MAN FROM

ANACONDA®

FOR BUTYL-INSULATED DURASHEATH

New answers to the problems of

SMALL PLANT SEWAGE TREATMENT



Just published!

*A brand-new
bulletin on revolutionary
new developments
in low-cost plants
for communities
up to 10,000*

Sewage treatment plants, with all essential operations performed mechanically and continuously in single, low-cost combination units, now bring the advantages of modern sewage handling methods within reach of even the smallest community.

With only one tank and one drive unit to operate, these new plants overcome the problem of high costs which often make conventional treatment facilities beyond the means

of small users. Latest improvements include mechanical grit removal combined with sludge digestion and clarification.

If you're interested in small plant sewage treatment for communities up to 10,000 or even for individual industrial plants, schools, motels or housing developments, you'll want the new bulletin shown above—just off the press! Write for Bulletin No. 6692 to Dorr-Oliver Incorporated, Stamford, Conn.



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80-GDS-8 runs 44,000 hours without overhaul, cuts fuel cost 50%, pays for second diesel!

Olin Mathieson's new aluminum plant on the Ohio River, 18 miles from Woodsfield, caused the town to grow more during 1957-59 than in the previous 25 years combined! Power consumption soared from 2,921,740 KW in 1956 to 4,167,260 KW in 1958, as acres of new worker homes hit the line.

But economy-minded city fathers and maintenance-conscious power plant personnel met the crisis, aided by two Superior engines. The first, an 80-GDS-8 dual-fuel of 600 KW capacity, entered service in 1950. During the next 7 years, it reduced costs per KWH 50% as compared to Woodsfield's 3 older straight diesels. After 44,000 hours operation, it was overhauled in 1958. The only replacements needed were connecting rod bearings. Piston rings were replaced, too, although their ".002" wear was well within tolerances.

This Superior did more than supply consumers with low-cost electricity. Power profits also financed various municipal improvements, including a second Superior engine-generator! The new 80-GDSX-8 supercharged dual-fuel of 1250 KW capacity commenced operation in early 1958. In addition to maintaining low fuel costs, it operates more than 50,000 horsepower-hours per gallon of lube oil!

For every municipal need, White Superior offers economical diesel, dual-fuel, or gas engines ranging from 190 to 2150 HP, or 150 to 1500 KW!

Superior engines power Woodsfield's boom!

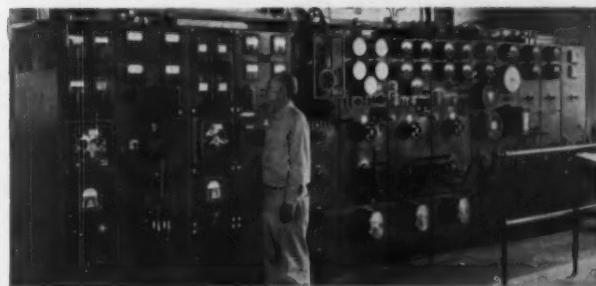


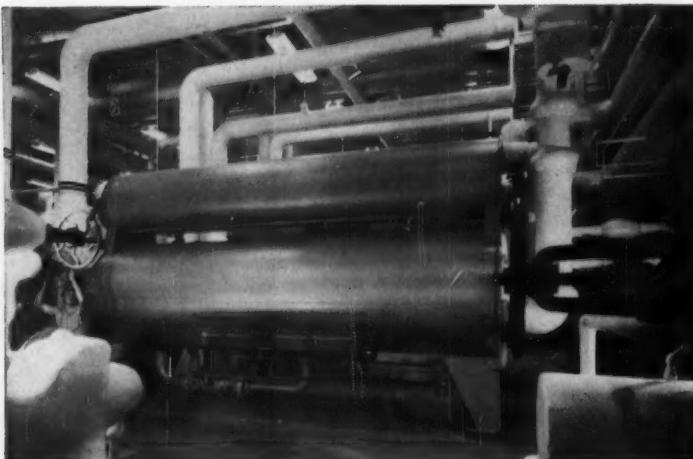
White Diesel

WHITE DIESEL ENGINE DIVISION
THE WHITE MOTOR COMPANY

Plant and General Offices: Springfield, Ohio

L. W. Marple, plant superintendent, checks controls
of town's five power-producing engines.





Push-button starting

Automatic STOP-and-GO

Time clock operation

Thermostatic control

First with 1000-ton Capacity... Carrier Absorption Refrigeration!

Fourteen years ago Carrier was first to bring the advantages of this remarkable machine that cools with low-pressure steam or hot water. Now Carrier is first again to offer an Automatic Absorption Refrigerating Machine that is big enough to handle the air conditioning loads of office buildings, hospitals, hotels, department stores and industrial plants with a single unit.

Today more than 1500 of these machines, ranging in size from 50 to 1000 tons capacity, are delivering dependable, low-cost refrigeration. This record is without equal in the industry. So you protect the investment of your clients when you specify Carrier, built by the people who know absorption refrigeration best.

Carrier offers a complete line of components to match the requirements of any refrigeration or air conditioning problem. For information, write the Machinery and Systems Division, Carrier Corporation, Syracuse, New York. In Canada: Carrier Engineering Ltd., Toronto.





"Quote . . . End Quote"

"In a survey of 622 engineers and scientists, 72 percent thought management misused their talent, and 80 percent said they were underpaid compared to other groups . . . most thought their goal in the company was pursuit of knowledge for its own sake and wanted less pressure from management, freedom to select their own work, flexible work schedule . . . managers interviewed showed good understanding of what engineers and scientists wanted, but called it a type of freedom that belongs to academic institutions, not to competitive industry."

—Opinion Research Corporation.

Contractors Optimistic For 1960

"Significant features of the private construction picture, in addition to a decline in housing, will be a sharp increase in industrial building, a continuing increase in commercial construction, and a high level of state and local public works. It is believed that a considerable amount of work tentatively scheduled for 1959 is being carried over into 1960 due to steel shortages.

"The 1960 outlook by major categories is as follows:

"Residential — A 4 percent decrease to \$21.4 billion in residential building, with about 1,200,000

new units started, compared with an estimated 1,350,000 starts in 1959. Within this category, however, apartment construction will continue to advance.

"Commercial — should increase more than 15 percent to about \$4.5 billion. An office building boom will be carried over into 1960, and the housing boom of 1959 will exert heavy pressure for [the construction of] suburban stores and other commercial establishments.

"Religious Structures probably will reach the \$1 billion mark in total for the first time.

"Public Utility facilities should resume an upward climb, possibly reaching \$5.5 billion, led by increases in construction by telephone and telegraph companies and the gas industry.

"Industrial Building, which declined sharply during the past two years, should expand 30 percent to more than \$2.5 billion as business concerns increase plant and equipment expenditures.

"Farm Construction, after a moderate rise in 1959, is expected to decline more than 10 percent.

"Highways and Streets are expected to remain at near the record-breaking figure of \$5.8 billion. While some momentum in the ex-



SHUR-SITE TREADS

*...the best step for
SAFETY*

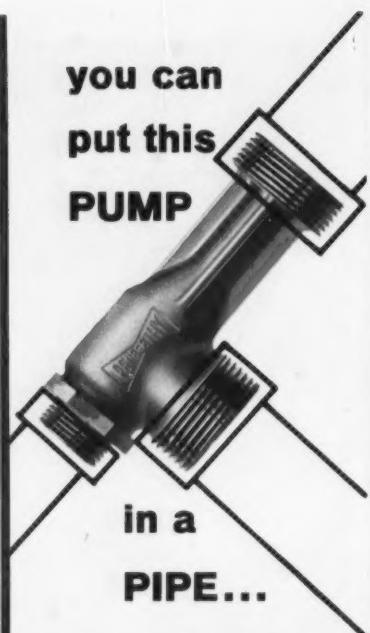
Hendrick Shur-Site Treads have a non-slip surface that insures safety, making them the best choice for your stairs, ladders and fire-escapes. A heavy nosing bar provides reinforcement where the load is greatest. Shur-Site Treads are constructed by a pressure forming process, and so have no angle irons, bolts or rivets to collect dirt and refuse. Their 90% open area lets in plenty of light and air.

Shur-Site Treads are available in standard sizes or in special widths and lengths. They are shipped ready to bolt directly to stair stringers.

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Sales Offices in Principal Cities

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PUMP**



**PENBERTHY ejectors
solve design problems**

Used in applications where mechanical pumps do not fit or are not economical, Penberthy ejectors simplify the handling of fluids, slurries, vapors, gases and even "hot" materials. Low-cost compact ejectors provide unique advantages in liquid transfer, heating, circulating, aerating, agitating, mixing, pumping, blending and in exhausting air or vapor against a high vacuum.



Series 1A and 20A



Series 60A



Special Service



Series 60P

Series 1A and 20A for a wide range of operations.

Series 60A, fluid operated, for lifting, elevating and blending liquids and slurries.

Series 60P in corrosion-resisting plastic, hydraulically operated.

Special Jet Pumps in choice of materials.

Your Inquiry will receive prompt, personal attention.

PENBERTHY

PENBERTHY MANUFACTURING CO.
Division of Buffalo-Eclipse Corporation
Prophetstown, Illinois

panded highway program will be lost under the influence of Federal contract controls and reduced authorizations, it is believed that a carry-over of some projects which were delayed by the steel strike will keep construction work near 1959 levels.

Public Educational Building, which declined in 1959, should experience a mild recovery, reaching \$2.8 billion. Construction of public elementary and secondary school classrooms should again exceed 70,000 in the 1959-60 school year, compared with only 68,500 in the current [1959] year.

"While bond issue proposals for schools and other local public works have been approved at a high rate by voters throughout the country, the tightening money market is presenting difficulties in carrying out the projects.

Sewerage and Water Facilities, however, should continue advancing under the heavy pressure of residential building and population increases, reaching \$1.7 billion, a 10 percent rise.

"Military Construction, with emphasis still shifting toward missile base facilities, should hold close to its 1959 level of nearly \$1.5 billion, depending upon budgetary actions of the government. The same holds true for Conservation and Development, which has gradually increased in recent years, totalling \$1.2 billion in 1959." — Annual Construction Review and Outlook, The Associated General Contractors of America, Inc.

Comptroller Hits Private Practice

"... [Pennsylvania Secretary of Highways, Park H. Martin] presented a general picture of the State's road-building plans at a 90-minute press conference called to discuss charges by the U. S. Comptroller General, Joseph Campbell, of waste and delay in the Federal-State road construction program.

"Among other things, Campbell charged that the state was spending \$1 million monthly to hire outside

[consulting] engineers to prepare plans and specifications for road building.

Martin pointed out that the \$49 million [spent for consulting engineer's services in the period from 1954 through 1958] was spent prior to the Administration of Governor David L. Lawrence.

"This year, he said, the practice has been continued because the department has been unable to hire an adequate staff of engineers, but the outlay has been cut to \$6 million a year instead of \$9.8 million.

"Martin said it would be impractical to build up a departmental staff capable of handling such a huge 'crash' Federal program. He said the use of consultants was more efficient and cheaper." — *The Philadelphia Inquirer*, December 31, 1959.

The End of a Yankee Tradition

"Perhaps nowhere in the country is the town dump quite the social center that it is in New England . . . on crisp autumn weekends, the head of the household could meet his neighbor and discuss, in passing, world politics, community problems, or any other subject that happened to strike his fancy.

" . . . located far away from populated areas where smoke and odors had very little effect, the open dump was inexpensive to establish and economical to run. But as more people were born into or moved into the community . . . the Board of Health took a dim view of further makeshift solutions . . .

"Of late, several schemes have been advanced which give even the small town an opportunity to build an incinerator. In a few States, legislation has been enacted permitting a private contractor to construct and operate an incinerator under a long term arrangement with a town.

"Another arrangement likely to become popular — and one being given serious consideration in New England towns — is the joint venture whereby two or more neigh-

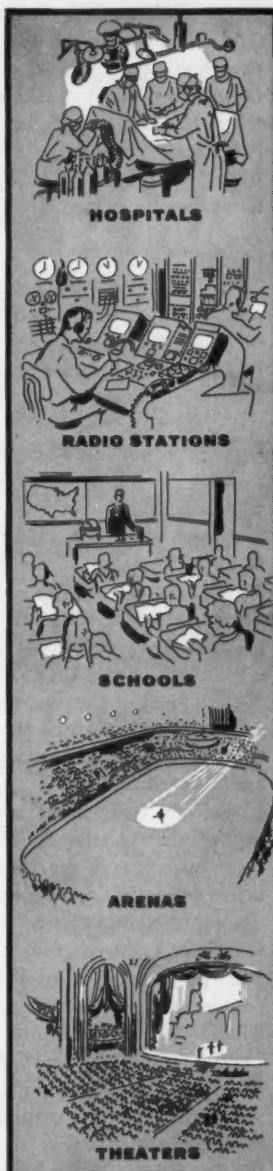
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• When power fails, transfer panels automatically switch a lighting or power load from the normal source to an emergency source. Often they are a legal "must" in churches, department stores, hospitals and other places where public safety is involved. They are also invaluable in radio stations, where expensive tubes must be protected from fast cool-off—in factories, where certain processes must not be interrupted—in any location where power failure can cause accidents or property damage.

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All the facts that you need to assure top and dependable master TV system performance. Contains information that is the result of more than 2,000,000 master TV installations that feature Blonder-Tongue Masterline components. Here's a preview of the contents:

TYPES OF SYSTEMS

New construction; old construction; vertically designed systems; horizontally designed systems.

COMPONENTS IN MASTER TV SYSTEMS

Amplifiers; splitters; tapoffs; antennas; transmission line.

THE "HEART" OF MASTER TV SYSTEMS

"Head-end"; amplifiers; line filters; feed-thru couplers; radiation-proof housings.

"ARTERIES" OF MASTER TV SYSTEMS

"Branching"; splitters; cable; tapoffs; isolation.

ANTENNA INSTALLATION

Orientation, "directivity"; signal strength; towers and masts.

LINE INSTALLATION

Balanced transmission; co-ax cable; RG/11U and RG/59U; 300 ohm ribbon line; baluns; matching transformers.

DESIGNING AND CALCULATING MASTER TV SYSTEMS

Typical system diagrams; vertical cable run systems; hotel/apartment—to 400 outlets, new construction, existing construction; horizontal cable run systems; School or hospital—100 outlets, new construction, hospital—400 outlets, old construction; trailer park system—148 outlets, new or old construction.

TESTING AND MAINTAINING A SYSTEM

Equipment for servicing a system; substitution method; field repairs; testing and maintaining cable.

CHARTS AND TABLES

Amplifier specifications; tapoff-isolation networks; cable characteristics; attenuator pad construction; half wave open ended stub traps, and more.

BLONDER-TONGUE—A HISTORY IN MASTER TV

Company background; products; services; Free engineering service.

GLOSSARY OF MASTER TV TERMS

Motel Master TV systems.

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boring towns pool their resources to build the plant . . .

"Any community can obtain a Federal loan to meet the expense of an engineering study. The money is allocated by the Housing and Home Finance Agency under P.L. 560 from a rotating fund to towns which are in most urgent need, and it does not have to be repaid until construction bids are advertised." — Fay, Spofford & Thorndike, Inc. Bulletin.

stream at the rate needed. The 11 percent loss is bad enough, but the fact is that even without this loss, the situation is serious.

"All in the engineering field should be alert for promising young people and make certain that their talents are channeled into the field. Many challenges lie ahead in the field of engineering, not only in rocketry, but in the vast number of projects which must be undertaken to meet the demands of our expanding economy. These . . . might well lag for lack of engineers." — Lawrence S. Waterbury.

European Engineering

" . . . The first thing that struck me, and forcibly, was that there exists in most of Europe no such breed of cats as a chemical engineer. Chemists—yes, engineers—yes, but the U.S. version of the chemical engineer — no. Furthermore, engineering schools do not seem to be producing any working chemical engineers in the U.S. mold although some now grant the degree. All European technical graduates are very strong on theory—the physics, mechanics, mathematics, chemistry—but they're short on [knowledge of] chemical processing, economics, and the practical applications of the theory to chemical plant design and operation.

"Perhaps I can sum this all up by saying that plant design, in its broadest sense, as practiced by our larger operating companies and engineering contractors is largely unknown as a native grown commodity. The concept of over-all project responsibility by an engineering concern which has only the customer's interest at heart is lacking. They attempt to substitute and synthesize this by calling on the equipment suppliers to perform these services for their equipment and its auxiliaries and then playing the suppliers off one against the other while hoping to get the best job. I think the commodity of know-how in processing and plant design is virtually monopolized by U.S.

Engineers and the Space Race

" . . . The exploration of space, like nuclear physics, is beyond the point of individual discoveries in the laboratory. It is being translated from a scientific into an engineering problem. Its results have been concrete enough to justify a major national effort. If the expenditure for future big space programs are huge, they are not insupportable. They can be made up partly from the clear economies of a sensible command setup." — The Missile Mess, by Frank Gibney, *Harper's Magazine*, January 1960.

Fewer Engineering Students

"There are divergent opinions as to why 11 percent fewer freshmen were enrolled in the nation's engineering schools last fall.

"While Northwestern Life Insurance Co. survey leaders attribute it to 'unwarrantedly pessimistic appraisals' of the effect of the 1958 recession on the engineering future, the new dean of engineering at Cornell, Dale R. Corson, says space rocketry is drawing potential engineers into other sciences.

"Dean Corson says a misconception is responsible—points out that satellite and rocket development are 'engineering, not scientific achievements.'

"Both views have merit. It is to be regretted that school counselors, parents, and students with talent for engineering are so shortsighted and so unaware of the facts that for the present, at least, new blood is not entering the engineering



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. . . new concept in elevating inspired by Elevonics*

A dramatic combination of architectural beauty and functional design, the new National Bank of Detroit has the most advanced system of electronically controlled elevators, keyed to the age of automation!

Seventeen Haughton Operatorless Elevators speed traffic from floor-to-floor, in regal comfort, and with uncanny speed and smoothness. They are motivated by an amazing "electronic brain" that anticipates service needs at every moment, and dispatches cars at proper times and in proper sequence to meet traffic needs *exactly*!

Such is the magic of Haughton Elevonics*, key to new advancements in elevator technology . . . and new standards of elevator performance, economy and comfort for multi-floor buildings of all types.

We are proud that Haughton Elevators have a part in maintaining the functional integrity of the new National Bank of Detroit. Their complete reliability is thoroughly recognized by building professionals. We will be glad to furnish you with complete information on Haughton design, modernization and maintenance capabilities.

*Haughton's advanced program in elevator systems research and engineering, with specific emphasis on the creative application of electronic devices and instrumentation for betterment of systems design and performance.

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firms the world-over, and it is the one thing Europeans really want and are willing to accept from us.

"The transfer of this know-how to other economies, other labor markets, other experience backgrounds should not be made without a careful study of all these factors and such modifications of American practice as appear necessary. The blanket adoption of American practice to a European plant does not, in my opinion, rep-

resent sound engineering. I would hasten to add that the reverse is equally true and a very messy situation can arise from the blanket adoption of European plant design or operating practice in the U.S.

"The European engineer is in general more highly regarded by the community than his American equal. This is not due to any planned professional activity but rather it is part of the general respect for a university degree and

title. The engineers play this to the hilt, and the title of Engineer or Doctor Engineer is widely used even in every day social conversation. Professional groups are not as varied as in the United States and such as exist are more concerned with policing and limiting entrance to the field than is true of our professional societies. Part of this stems from the attitude with which most Europeans regard their profession or trade in speaking of their 'career' as waiters or welders or engineers. The limited facilities for higher engineering education, the mark of distinction that an engineering degree brings, and the improved economic situation engineers can achieve all lead to fierce competition for the relatively few scholastic openings.

"The pay scale of the European engineer is low by U.S. standards. However, it should be judged against the European economy and on this basis is probably higher on the average than comparable earnings in the U.S. Two other factors which confound any comparison of earnings are (1) the heavy fringe benefits most Europeans enjoy in contributed social security, company hospitalization plans, paid legal holidays, longer vacations for the same years of service, family allowances, etc., and (2) the European practice of awarding 'bonuses' ranging from one month's pay to as much as six months' pay which extends much further down in the organization than in the United States.

"In closing let me say that I feel European engineers and engineering are capable of constructing and operating any type of processing plant that American processing and design know-how can present; I would hesitate to say they possess the experience and know-how to perform the plant processing and design without assistance from American engineers." — Eric Jenett, *The Slide Rule*, Houston Engineering and Scientific Society, Houston, Texas, January 1960. ▲

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In a single packaged unit, Maxim Heat Recovery Silencers do the job of both boiler and silencer. This saves the cost of installing two separate pieces of equipment, conserves valuable space, and minimizes back pressure. Because Maxim equipment operates either wet or dry, your diesels can run continuously even if waste heat is used only intermittently. Highly efficient for recovery of waste heat, Maxim Heat Recovery Silencers combine this with the optimum in noise suppression—of special importance in populated areas.

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A new, extremely lightweight, closed cell synthetic, U200 has excellent heat and chemical resistance. Its K factor is only 0.14 at 70° F. mean temperature... lowest on the market. Density is only 2.3 lb. per cubic foot. Yet this remarkable, new material has high compressive and flexural strength. It's non-toxic and easy to handle, too.

Try it just once and you'll see how quickly and easily it can be cut and applied with a very minimum of standard hand tools. It can actually reduce application costs by as much as 50%.

Available in accurate, half-round sections; in nominal thicknesses and in standard pipe sizes. Individual sections 36 inches long. Also available in 12" x 36" block form—1" to 5" thickness in $\frac{1}{2}$ " increments.

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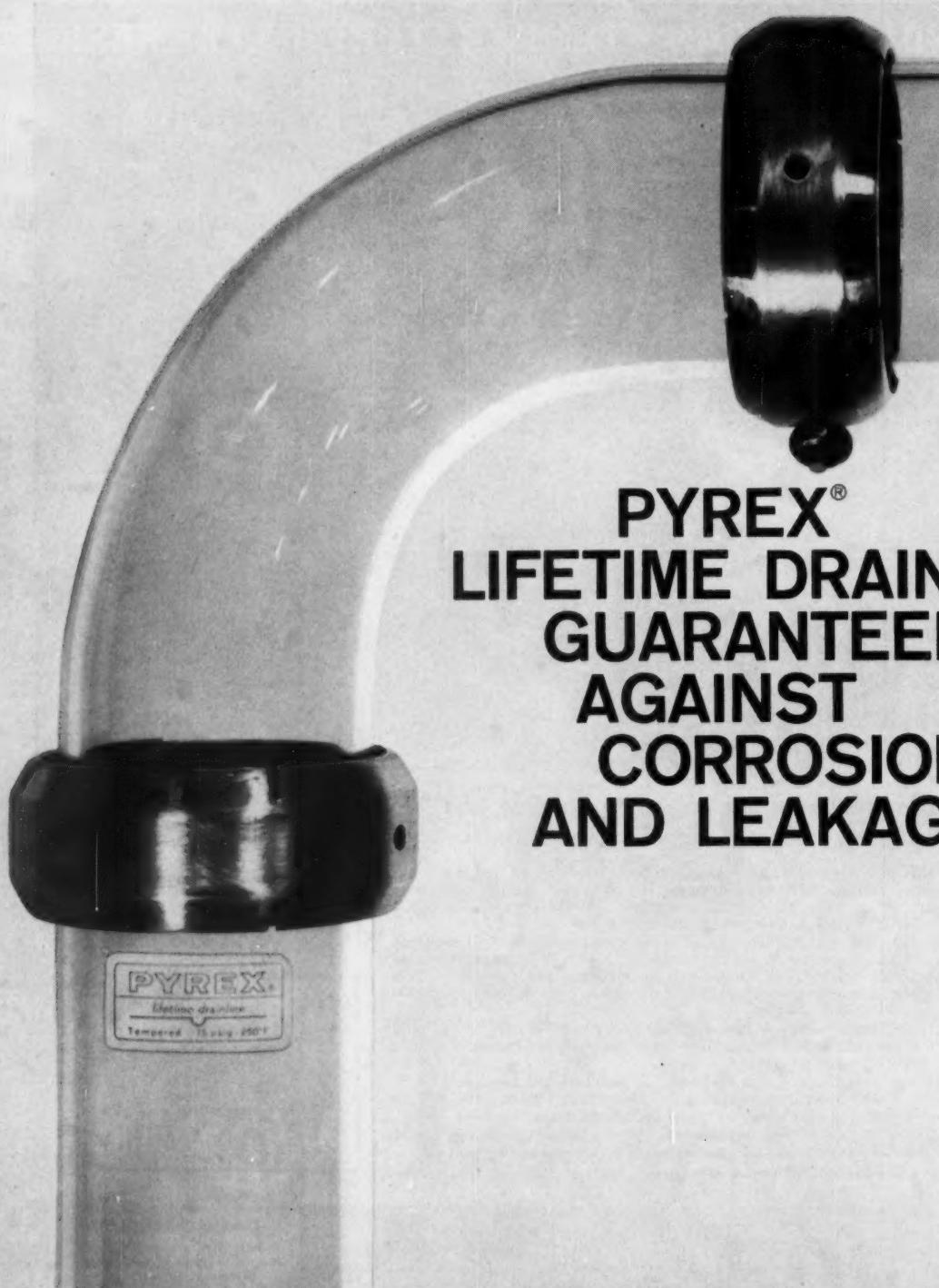


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WAGNER Dry-Type General Purpose Transformers

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WHILE THEY WORK

New...from Wagner...totally enclosed dry-type transformers filled with epoxy compound. Their designation: Type AE Single Phase, 1 to 10 Kva.

Use these transformers for all general purpose applications, including those where noise must be minimized. They have a low sound level...the result of encasing smaller Form W core and coils in solid epoxy compound. The compound insulates, reduces sound-producing vibration caused by core excitation...and provides enough support and mechanical strength to eliminate the need for metal framework and other sub-assemblies that are subject to vibration. *The result:* a whisper-quiet transformer that can be used anywhere, even in quiet areas of offices and hospitals.

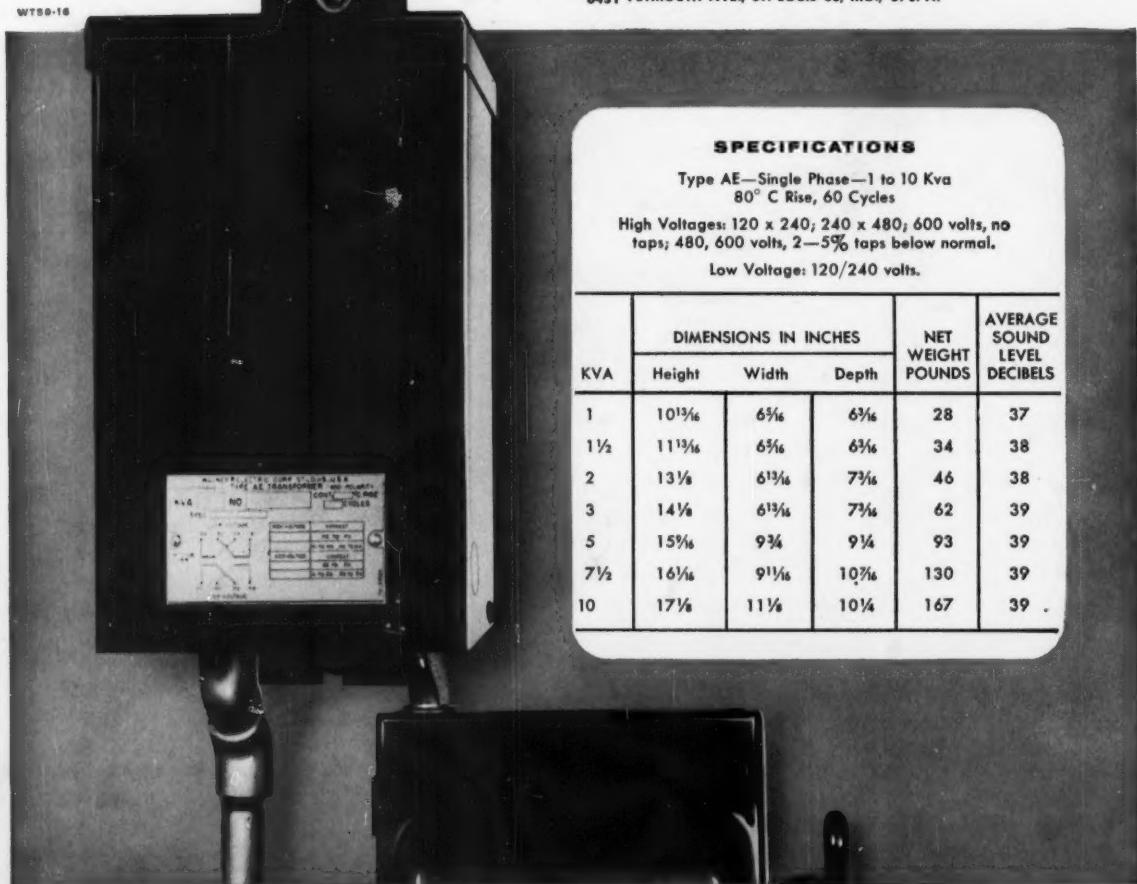
Wagner Type AE transformers do more than silence sound, of course. They improve voltage regulation, and have better insulation protection (suitable for continuous operation at 80°C in a 40°C ambient). All parts are sealed from dust, moisture and corrosion by the epoxy compound. Naturally, every unit is built to conform to all applicable standards of ASA and NEMA.

Wagner Type AE transformers can be installed indoors or out...in any location where they will not be submerged or exposed to injurious fumes in concentration. They are compact and lightweight and can be mounted in any position, at any angle...on walls, floors, or ceilings.

Like to know more? Wagner branches and distributors have all the details. There's one near you. Call or write now.

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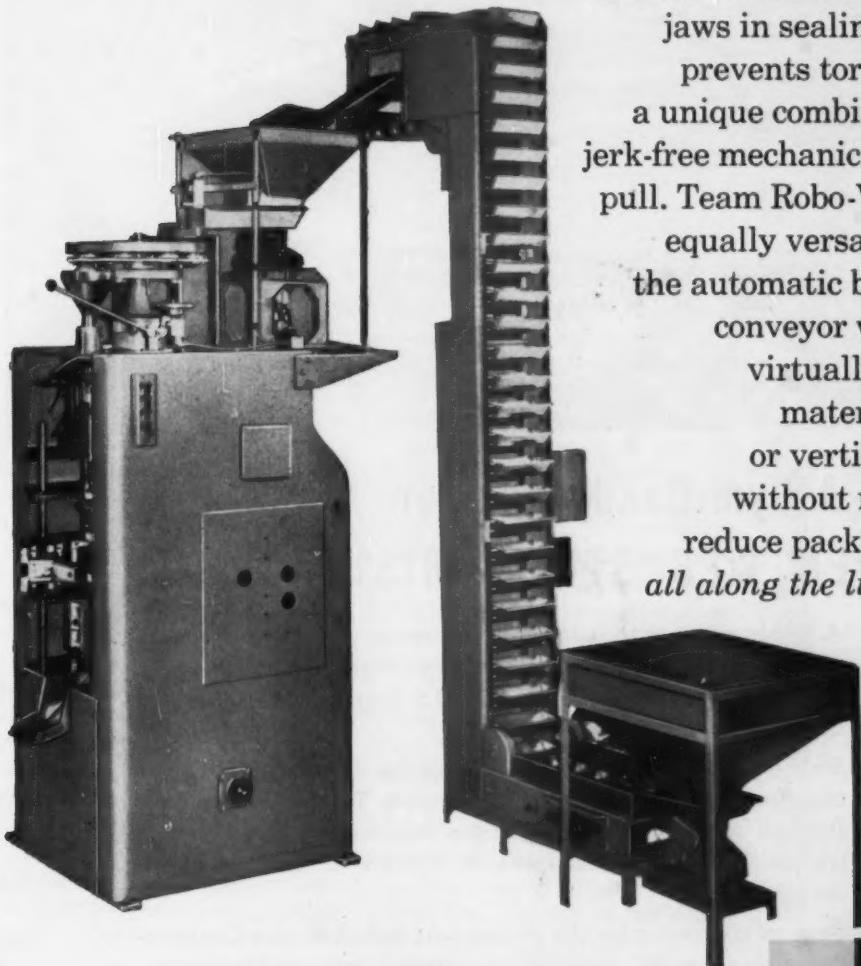
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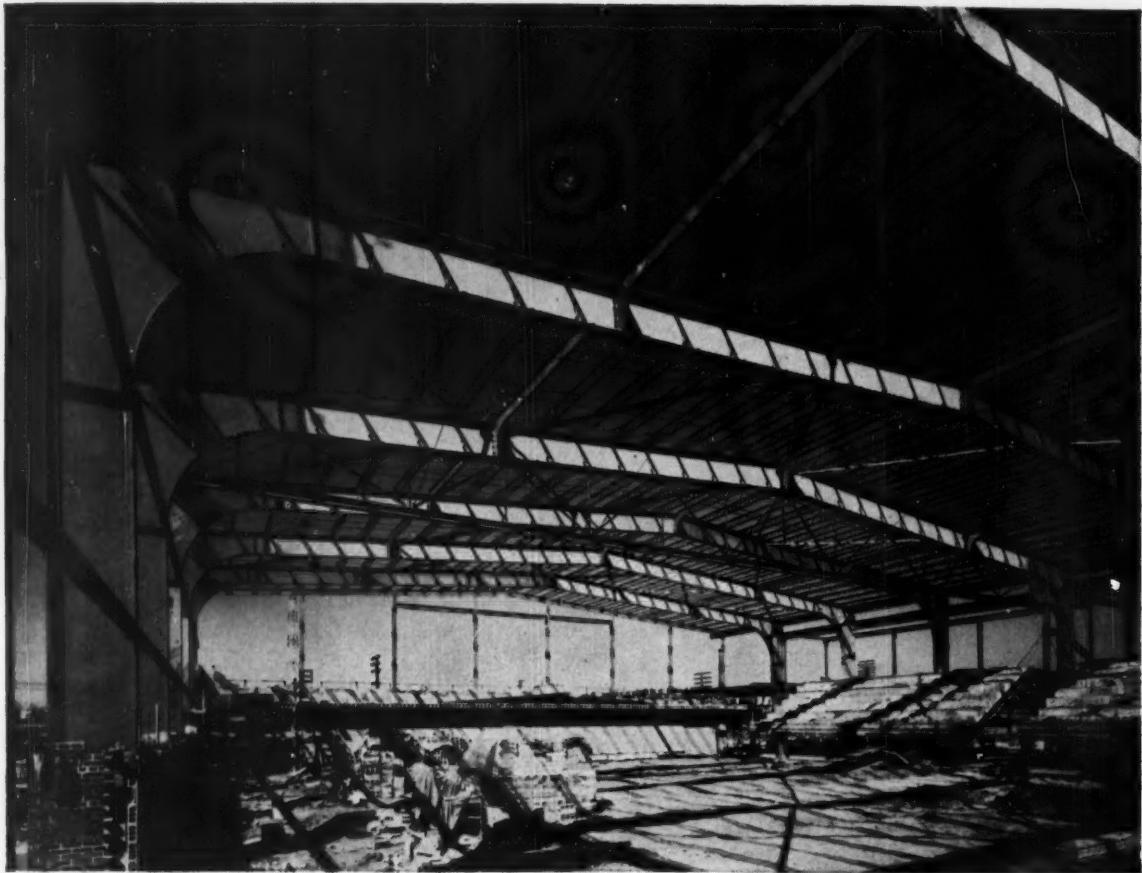
LEADERS LOOK TO LYNCH— FOR MACHINES THAT PACKAGE ALMOST ANYTHING!

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A Gym-Dandy Use for LACLEDE OPEN WEB STEEL JOISTS

A highly efficient type of construction was used for the modern new field house, O'Fallon Technical High School, St. Louis. The mammoth structure will house a gymnasium, auditorium and swimming pool.

Steel girders span the entire width of the building, leaving the floor area unobstructed by center columns. To provide maximum strength with minimum weight the roof was constructed with Laclede Open Web Steel Joists stabilized with continuous horizontal bridging.

General contractor for the project was Robert Paulus Construction Company, St. Louis, in cooperation with architects and engineers of the Board of Education, City of St. Louis.



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◆ Producers of Steel for Industry and Construction



Heard Around Headquarters

THE New York Association of Consulting Engineers, which recently held its first annual meeting since becoming a corporation, ended the past year relatively contented, if not rich.

John Hennessy, Jr., who was re-elected president, said the Association hopes to encourage a number of the City's leading civil engineering consultants to join within the next few months. Last June, the by-laws were amended to allow civil consultants to become members. A list of prospects has been approved by the board, and the next task will be acquainting the civil consultants with the advantages of being Association members.

A slight dues increase has been voted for 1960. However, Hennessy said the Association's financial situation has become fairly stabilized and any substantial increase in future budgets must be financed by increased membership.

The Association still has not appointed a specific member as a delegate to Consulting Engineers Council, and "is not likely to in the future," Hennessy said. "We think letting different people attend the CEC meetings will result in greater over-all enthusiasm through more general participation."

The Association's education committee recently surveyed the mem-

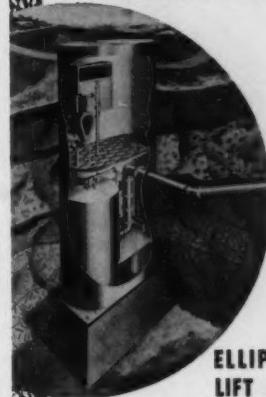
bership and found widespread interest in getting more top students into the offices of consultants. Members are planning to start a program for hiring undergraduate students during the vacation months to increase their interest in the field of private practice and to accelerate their intellectual development.

The major medical group insurance program, which ends its fiscal year in February, has increased rates by 40 percent. However, the benefits were reported to be well worth the cost. To date, more than \$23,000 has been paid in claims, which averaged \$400 to \$500 each. Biggest bills have been for psychiatric care, so the trustees are considering the desirability of reducing the coverage of psychiatric care from 80 to 50 percent.

Within the next few months, the Association plans to publish a Year Book, which would include the names and addresses of members. Hennessy also is hoping to form a joint committee with the New York City Chapter of the American Institute of Architects to compile a publication aimed at the architect client entitled, "How to Select a Consulting Engineer."

The structural codes committee has been working for some time to get the city to allow architects or engineers to approve occupancy

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LIFT STATION**

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EXCLUSIVE SHELL WITHIN-A-SHELL DESIGN

Elliptical-shaped outer shell completely encloses the air storage tank and sewage receiver of this simplex sewage ejector station. This unique design provides maximum protection for all components — plus easier maintenance and modification. Any component can be removed and replaced without removing the outer shell.

SUPERIOR COMPONENTS FOR EXTRA DEPENDABILITY

Brand names of motors, compressors, controls, and other Ellipto-Ject components are among the most dependable in American industry. You know you are getting the best when you specify Ellipto-Ject.

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Ellipto-Ject pneumatic ejector stations are setting new standards. Names of municipal and industrial users on request.

Let Tex-Vit help with all your sewage lift problems. Tex-Vit also manufactures Delta-Ject, a duplex station incorporating the same design principles as the Ellipto-Ject. Other Tex-Vit products include pneumatic ejectors and packaged pump stations.



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In any batching operation—from simple dump-and-fill weighing to multi-ingredient ratioing—W-C Batch-Weighing Systems provide the reliably accurate net-weight control essential to consistent product uniformity.

Chief reason for this is the W-C Pneumatic Weight Transmitter. A rugged yet sensitive force-balance unit, it is capable of an accuracy of $\pm 0.25\%$ calibrated weight range, with reproducibility better than 1 part in 2000.

Each W-C Batch-Weighing System is designed to job specifications, using pre-engineered, unitized components of known performance capabilities. Consequently, you are spared the uncertainties—and costs—of "prototype" engineering . . . yet you realize the very tangible benefits of an application-engineered system built to your requirements.

Typical applications include:
Formulating solid rocket fuels, refractories, varnishes, plastics, food products, dry or liquid.

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certificates. Currently, the building owner must wait until the understaffed buildings department can send over an inspector to approve occupancy. The change is expected to receive approval within the next few months.

Membership Grades Redefined?

The American Society of Mechanical Engineers Council has recommended a constitutional amendment elaborating on the qualifications for associate and affiliate membership. The constitution presently requires an engineering degree from a school with an approved curriculum or at least eight years of engineering experience for associate membership.

The proposed amendment would expand on these provisions:

"Graduation from an engineering curriculum approved by Council shall be accepted as equivalent to the 8-year experience requirement. Furthermore, appropriate credit toward the 8-year requirement will be given for the following: Graduation from an engineering curriculum not approved by Council, completion of portions of engineering curriculum, completion of a course of study in a technical institute, or other recognized educational programs. Credit also is given for the holding of a professional engineering license as specified in the Constitution and Bylaws."

To qualify for affiliate membership, a grade reserved for nonengineers, an applicant currently must have a "record of recognized leadership in some profession, or branch of industry, or science relating to engineering, and shall be qualified to co-operate with engineers in the practice of their profession and he must be at least thirty (30) years of age."

The proposed amendment still would not require affiliates to be engineers, and would eliminate the age restriction. As now written, a candidate for affiliate membership must have "(a) attained a position of policy-making authority and

recognized leadership in some pursuit related to engineering, and (b) demonstrated an aptitude for co-operating closely with engineers and a marked enthusiasm for furthering engineering advances."

Jersey to Join

The New Jersey Association of Consulting Engineers has voted to ask for Consulting Engineers Council membership at the CEC annual meeting in Portland, in May.

The action was taken during a meeting at which CEC Secretary Howard Eckerlin explained the aims and history of the Council. Prior to this meeting, there had been some discussion of a possible merger with the New Jersey Society of Professional Engineers functional section for consultants.

Consultants Mentioned

After receiving a statement of principles from the Consulting Engineers' Section of the Kansas Engineering Society, the Kansas State Chamber of Commerce has amplified its policy statement.

As might be expected, the Kansas Chamber has long favored private enterprise, but the new policy statement is more specific, and it contains a favorable mention of consulting engineers.

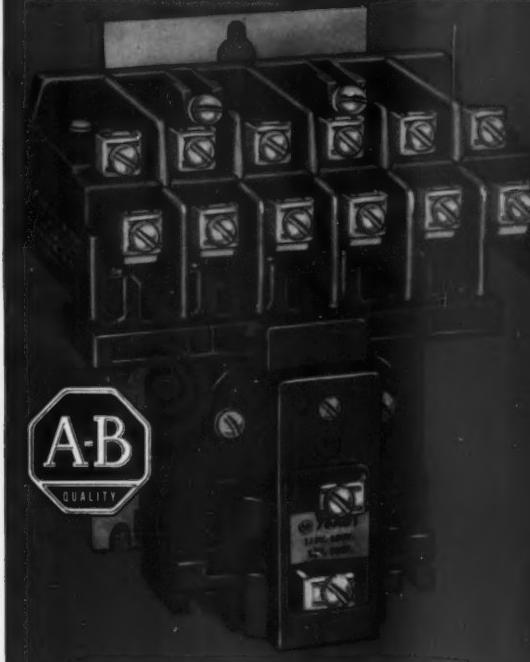
PEO Elect Officers

New officers elected at the annual meeting of Professional Engineers of Oregon on November 13 and 14 included the following: president, James D. Caulfield, of Caulfield and Caulfield, consulting engineers; vice president, Darel A. Riechel; treasurer, Robert M. Bonney, of Moffatt, Nichol and Taylor, consulting engineers; secretary, Ralph F. Delson.

Headquarters Cost Increases

Original announcement of the new United Engineering Center, now being built on New York City's United Nations Plaza, estimated the cost of the land and the building at \$10 million. Quotas for the engineering societies' member gift

IT'S NEW



Bulletin 700 Type BR Relay with all six of the convertible poles arranged for normally open contact operation.

Allen-Bradley Convertible Contact CONTROL RELAY

BULLETIN 700

TYPE BR

Changeover made in seconds!

The contacts of the new Type BR relay can be arranged for either normally open or normally closed operation—and any changeover in the field can be made in seconds. A screwdriver is all that's needed.

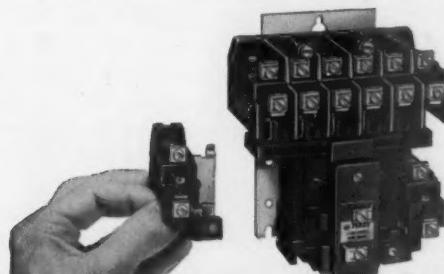
This new A-B Bulletin 700 Type BR relay is ideal for use on automatic machines where control functions are frequently altered to meet production changes.

Quick convertibility of the contacts enables easy "on-the-spot" changes—from "normally open" to "normally closed"—or vice versa.

These new Bulletin 700 Type BR relays have been exhaustively tested to make sure that they will provide

the many millions of trouble free operations for which all A-B controls are famous. In fact, the Bulletin 700 Type BR relays will establish new standards for long relay life and "reliability" of contact operation. Of course, they have double break, silver contacts that never need attention; also, the cast-plastic coil is impervious to the most severe atmospheric conditions.

Please write for full details, today!



Two extra convertible poles can be easily added—in the field

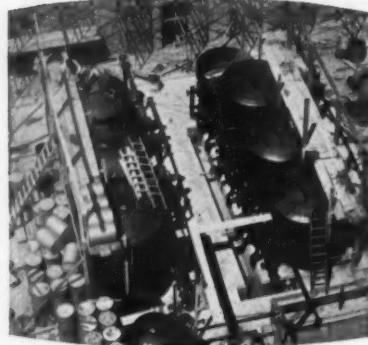
An auxiliary convertible contact pole—having full switching capacity—can be easily added to the left and right sides of the Type BR relays. These auxiliary poles are front-mounted and can be added without disturbing the wiring of the relay—and without removing the relay. All relays are designed to also accept stab connectors, and—all terminals are accessible from the front.

Allen-Bradley Co., 216 W. Greenfield Ave., Milwaukee 4, Wis. In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

ALLEN-BRADLEY

QUALITY
MOTOR CONTROL

PATHWAYS OF A PIONEER



This picture was taken in 1943 of a Continuous 600 gpm IonXchanger during installation at a midwestern chemical plant. The tanks are shown being loaded with ionXchange resins.

Blazing the Trail for De-I Developments

When the photograph above was made, IWT already had well over 50 large industrial ionXchangers in successful operation — yet ion-exchange in those days was still considered a "new and untried" process! Many of these pioneering IWT installations are in use today, and most of the early users of IWT ionXchange have added to and modernized their equipment as new developments became available.

Even today IWT is still pioneering — adding to its great stock of knowledge in this specialized field, designing and building up-to-date ionXchangers of all types and sizes for application to a wide variety of processes as well as all kinds of water-treatment, experimenting with and carefully testing new ionXchange uses, and constantly improving existing designs.

THIS EXPERIENCE CAN MEAN A LOT TO YOU

If you need pure water for high-pressure boiler make-up or process use, or if you are considering the use of ion-exchange for purification or concentration of chemical products, be sure to take advantage of IWT pioneering experience and specialized knowledge. Call your IWT representative.

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NEW YORK OFFICE: 141 E. 44th St., New York 17, N.Y.
CANADIAN DIST.: Pumps & Softeners, Ltd., London, Ont.

campaign were set accordingly. Latest estimates indicate the cost to be more like \$12 million. Inflation and more tenants than were originally expected contributed to the increased cost. However, added revenue from the new tenants is expected to provide the additional funds. In early January, the industry gifts campaign had netted \$4,731,000, and \$2,915,000 had been collected from the member gifts campaign.

Cancel Contract

The Western New York Chapter of the New York State Association of Consulting Engineers found out that the Niagara Frontier Port Authority had signed a contract with a Washington, D. C. firm of non-licensed engineers.

A complaint was filed with the N. Y. State Education Department and with the City of Buffalo. "It developed that this contract was given in payment of past political favors," James N. DeSerio, State Association president, said.

The result? The Niagara Frontier Port Authority cancelled the disputed contract and retained a properly licensed engineer.

Mission to Moscow

The State Department and the National Science Foundation have requested the Engineers Joint Council to prepare a proposal for a "Mission to Russia" this year. Although details have not been worked out, the study tour probably would include about a half dozen engineers. Utilization of engineers in the Soviet would be studied. A late April departure tentatively has been set.

Engineer vs. Architect

Where is the border between architecture and engineering? For several months the question has been argued in special hearings in New Jersey, and from all indications the hearings will not be over soon.

It all started with William J. McCamy, a New Jersey consulting engineer. He has been accused

of practicing architecture illegally because of some designs he made for a country club and for a private residence. Currently, hearings are being held before two professional engineers, two architects, and a deputy attorney general.

If the special board holds that McCamy was acting as an engineer and not practicing architecture, the charges will be dismissed. Otherwise, McCamy could be taken to court and a considerable fine levied against him.

Congress of the Professions

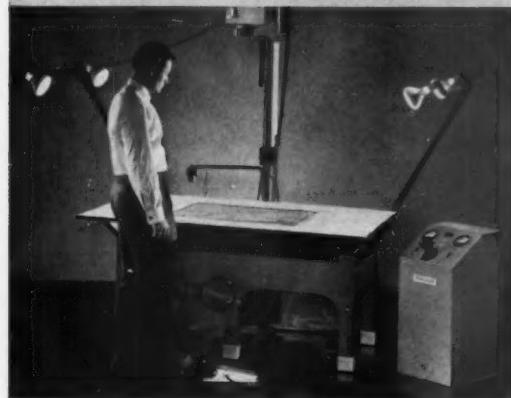
The Michigan Association of the Professions held its first annual congress on January 22 and 23. Membership in the new group — a state-wide movement to unite the professions and draw them more closely together in their efforts to serve the public — now totals over 3000, including 521 engineers.

At present MAP accepts individual memberships only from members in good standing of five recognized professional groups: Michigan State Medical Society, Michigan Society of Architects, Michigan Society of Professional Engineers, Michigan State Dental Association, and State Bar of Michigan. However, as more such organizations are studied and given recognition, other learned professions undoubtedly will be admitted to MAP. Groups in other states already have indicated interest in forming their own groups, and a national organization may not be far in the offing.

Five committees have been established to deal with problems of education, legislation, publications, public relations, and business services and techniques. The organization already has in force a group term life insurance program, and major medical, business overhead, and long term disability insurance are being considered. However, these are considered only side benefits to the Association's major objective of gaining full recognition for the professional. ▲▲

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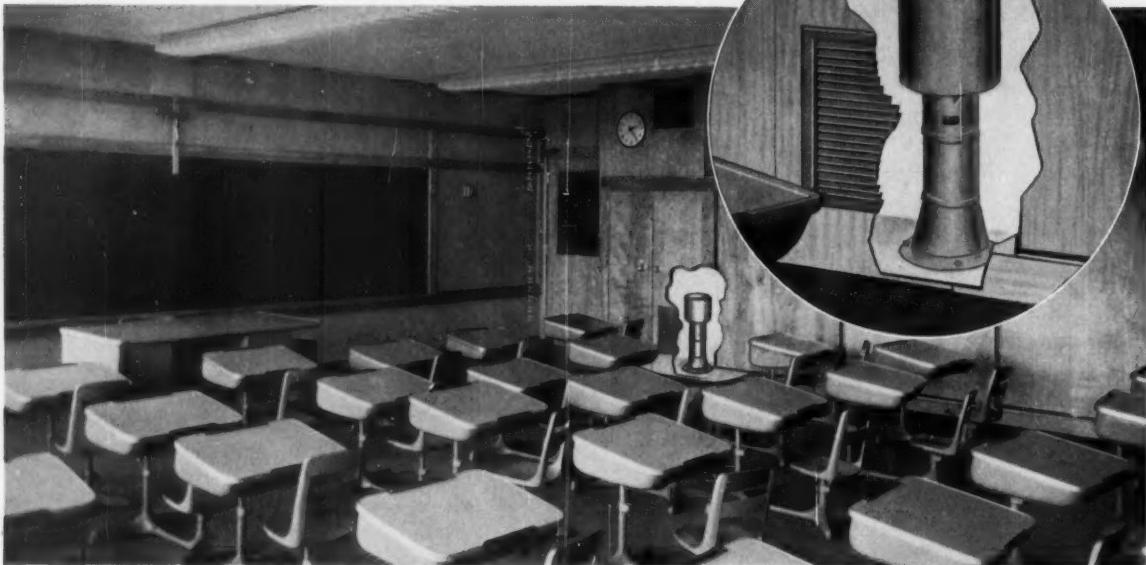
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Architect: Edward Roock, Syracuse, N. Y.
Contractor: Kenneth A. Taylor, Inc., Syracuse, N. Y.

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CONCRETE PERFORMANCE REPORT:

Pozzolith helps Norfolk and Western Railway Company speed tunnel concreting operation and assure maximum durability on 8270-foot tunnel project.

Sandy Ridge Tunnel—recently completed Norfolk and Western Railway Company project near Carbo, Virginia—is described as the longest railroad tunnel in Virginia or West Virginia.

Constructed to serve new coal mine properties developed by Clinchfield Coal Company, Division of The Pittston Company, the arch-type tunnel represents the major part of a \$7 million investment. The project also included the building of 6.3 miles of main line railroad and about 9 miles of spur and operation tracks. A concrete highway bridge and a concrete underpass were

built to effect grade separation between the railroad and a highway.

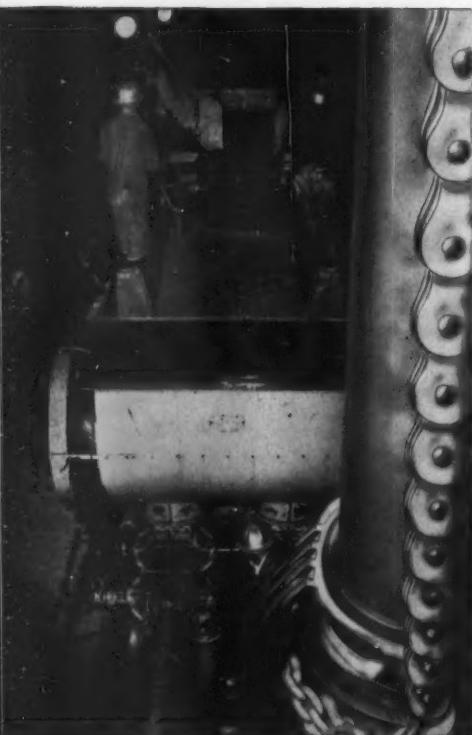
Sandy Ridge Tunnel was constructed from both ends, and, when the tunnel bore had been completed, the concrete floor and ballast walls were poured in order that track could be laid in the tunnel. Track through the tunnel was laid in prefabricated panels and was completed in 3½ days. Approximately 5 miles of track had already been laid north of the tunnel, using material hauled in by trucks. This enabled the Railway Company to give quick service to coal mines developed by the Clinch-

was to permit stripping of each 60-foot steel form so it could be moved to the next position and refilled every 24 hours. A 3,000 psi compressive strength at 28 days was specified.

Exceptionally good workability was also required of the mix to assure successful placing with pumped concrete. And an extremely high degree of concrete durability was necessary to meet the 50 years service life anticipated for the tunnel.

Work on design of the concrete mix to achieve this early form-stripping schedule and meet the other engineer-

SANDY RIDGE



PLACING OF CONCRETE—The mix was pumped to the top of 27-foot high forms through 6-inch slick lines (foreground), then vibrated into place. Pozzolith helped provide the exceptional workability required for this type of operation.

field Coal Company. Two train movements a day were maintained through the tunnel during the concreting operation with practically no delays to trains or the contractor's progress.

The plan was a success—the result of extraordinary teamwork among the mine owners, Norfolk and Western Railway Company personnel, the contractor—and modern advances in concrete technology.

Boring and Mucking Out—Boring of the Sandy Ridge Tunnel began at the south portal on July 3, 1957, and at the north portal on September 27, 1957. The tunnel was holed through on May 17, 1958. During the 10½ months from the start of the initial boring operation until the tunnel was holed through, approximately 190,000 cubic yards of material—mainly seam sandstone, unstable shale, and coal—were removed.

The unstable nature of material surrounding the bore required installation of steel H-beam supports placed on an average of 4-foot centers. Four-and-one-half million pounds of these structurals were used in the tunnel. In addition, 1-inch steel reinforcing rods were installed on 2-foot centers between the H-beams when the concrete was placed.

Designing the Concrete Mix—Primary requisite for the mix to be used in Sandy Ridge concreting operations was that it develop high early strength—740 psi in 10 hours. This

ing requirements, began six months prior to actual placing of concrete on-the-job.

Norfolk and Western engineers and the contractor, Ralph E. Mills Company, investigated the availability and quality of local materials. One-inch top size Pounding Mill stone and dolomitic sand were decided upon because of their favorable durability record. A Type I cement was selected, and samples of these materials were forwarded to the engineering laboratory of The Master Builders Company in Cleveland, Ohio, where studies were made of the rate of hardening characteristics of concrete with various cement factors and admixture formulations. The rate of hardening test employed was the Bond Pin Pull-Out Method described in ASTM Proceedings, Vol. 57, 1957.

The results of these studies were returned to Norfolk and Western engineers who analyzed the data and selected the following mix. For one cubic yard:

Cement:	517 lbs. (5½ sacks)
Sand:	1485 lbs.
Stone, (1"):	1800 lbs.
Water:	27 gals.
Pozzolith:	1.375 lbs. (¼ lb. per sack cement)
Calcium Chloride:	11.0 lbs.

This mix performed most satisfactorily and gave sufficiently high strengths (with a margin of safety) to permit 10-hour form stripping at the 60° aver-



NORTH TUNNEL PORTAL—The great difference in elevation on the two sides of the rugged Sandy Ridge Mountain required a 150-foot cut in the north approach to avoid excessive track grade.

THE SANDY RIDGE TUNNEL project was planned and carried out under the general supervision of A. B. Stone, Norfolk and Western Railway Company Chief Engineer (since retired), Walter L. Young, present Chief Engineer, and B. E. Crumpler, Assistant Chief Engineer.

N & W Resident Engineers, C. W. Fiery and W. B. Cole, supervised the building of the tunnel under the direction of Pocahontas Division Engineer, L. A. Durham, Jr.

Contractor for the job was the Ralph E. Mills Company of Salem, Va. and Frankfort, Ky. General Superintendent and Project Manager—J. M. Lipscomb. William Houston was Tunnel Superintendent at the north portal and Richard Bingham at the south portal. Concrete tunnel lining operations were directed by Gus McMullin.

TUNNEL

age temperatures that prevailed in the tunnel.

Mixing and Placing Operations
—Concrete materials were dry-batched in 1½ cubic yard lots then transported to a 2-cubic yard dual power paving mixer at the south portal. The 4-inch slump concrete was finally discharged into rubber-tired dumpcrete bodies for delivery into the tunnel.

Concreting of the floor, curbs and footings proceeded immediately after the tunnel was holed-through. After curing was completed and tracks were laid, the tunnel opened for rail traffic on July 28, 1958—13 months after boring began.

Concreting of the tunnel lining began almost simultaneously at the midpoint of the tunnel and at the north portal. Two specially-fabricated, 60-foot long steel forms were used. Mounted on wheels, they were moved on 85-pound rails laid along the ballast wall.

The form was filled by pumping

concrete at a rate of 50 cubic yards per hour. An average of 330 to 400 cubic yards was required for each 60 feet of tunnel lining. The concrete pump was part of a rail-mounted jumbo with two 6-inch diameter slick lines.

The POZZOLITH concrete mix had excellent coating of the aggregate and maintained its workability throughout the hauling and pumping operations. Only a few minor delays were encountered in pumping the concrete due to blocked lines.

The placing equipment was moved back and forth through the tunnel, alternately filling one form during the day shift and the other during the night shift. Twice daily, the jumbo was completely withdrawn and moved onto a siding to permit the coal-hauling operation previously described.

POZZOLITH and Master Builders Field Service—A total of 61,870 cubic

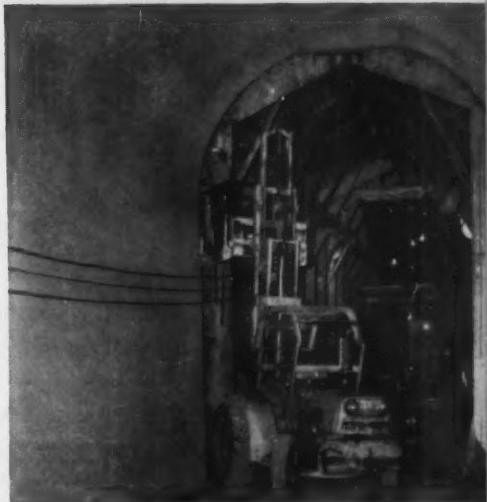
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yards of concrete were placed in Sandy Ridge Tunnel. POZZOLITH was used in approximately 50,000 cubic yards of the concrete and helped meet a broad range of engineering requirements. POZZOLITH was not used in the concrete floor and ballast curbs in the tunnel. Compressive strengths that permitted 10-hour stripping of forms were easily and economically achieved with a combination of POZZOLITH and calcium chloride. Other benefits resulting from POZZOLITH included reduced shrinkage and cracking, lower permeability and increased bond to steel.

From early planning through completion of the job, Master Builders field men and the Company engineering staff worked with the contractor to achieve uniform, superior quality concrete at lowest cost-in-place.

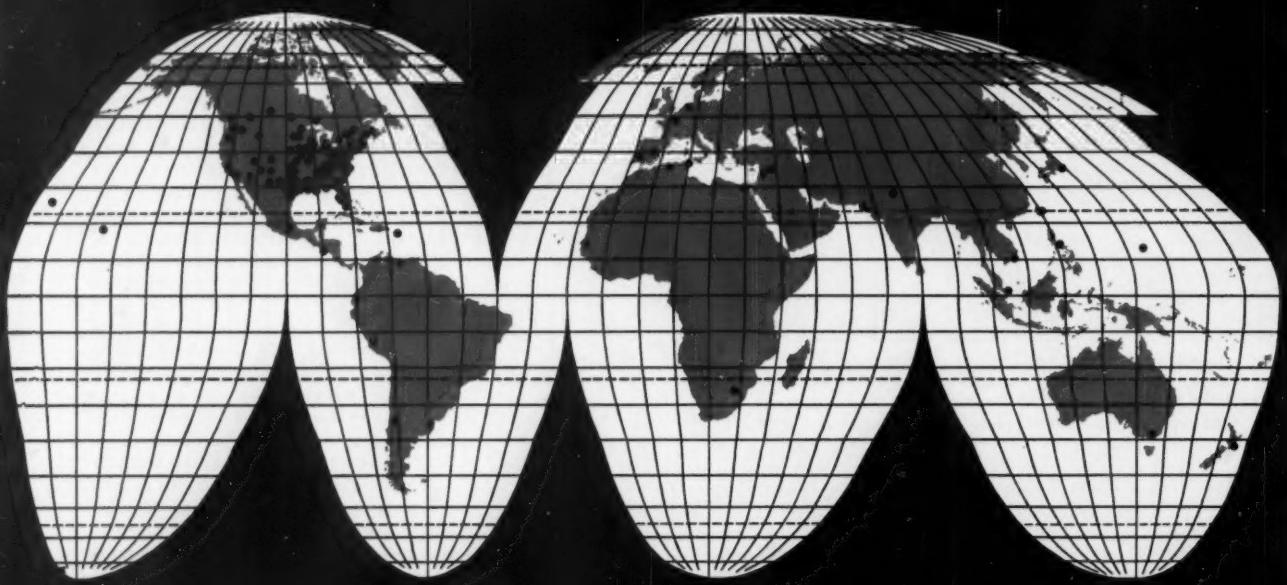
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FORM STRIPPING—In spite of forms being stripped every 10 hours, this work was carried out with no interruptions to coal shipments through the tunnel. Smooth, crack-free concrete surfaces required almost no finishing.

MASTER BUILDERS. POZZOLITH*

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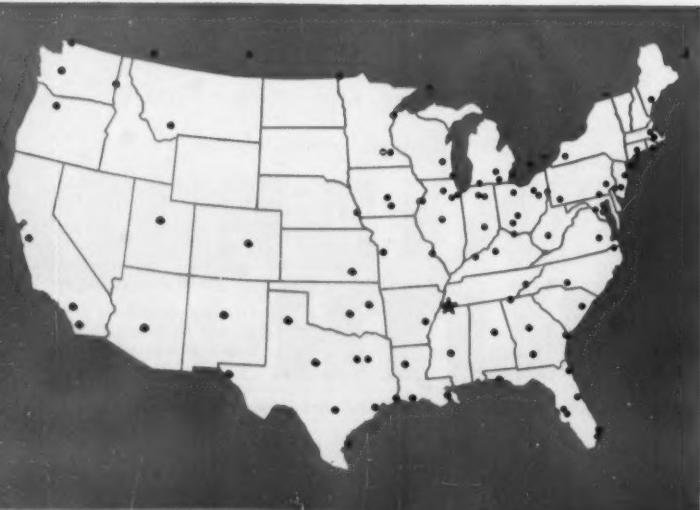
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The Legal Aspect

MELVIN NORD, P.E.

Consultant in Legal and Technical Problems

Patent Attorney

The Law of Real Property:

Zoning Ordinance Cases

ZONING ORDINANCES are frequently under fire in the courts. Hence, consideration of a few relatively recent cases is important to a fuller understanding of the subject.

Airports in Residential Zones

Aviation Services, Inc. and Town of Morristown v. Board of Adjustment of the Township of Hanover, 119 Atl. (2d) 761, a 1956 New Jersey case, raised the question whether a municipally owned airport was immune from the zoning ordinance of the township in which the airport was located.

The statutory authority under which the airport was built read as follows: "The governing body of any municipality may acquire, establish, construct, own, control, lease, equip, improve, maintain, operate, and regulate airports or landing fields for the use of airplanes and other aircraft within or without the limits of such municipality and may use for such purpose any property, owned or controlled by such municipality, suitable therefor."

Subsequent to the building of the airport by the Town of Morristown, and its lease to Aviation Services, Inc., for operation by the latter, the Township of Hanover, in which the airport was located, classified this area as a residential area. Suit was brought by the Town

and its lessee, seeking a declaratory judgment holding the Township's zoning ordinance to be inapplicable to the municipal airport.

The New Jersey Supreme Court held that the airport was immune from the operation of the Township's zoning ordinance, basing its decision on the necessity for construing the statute in a liberal manner so as to effectuate its purpose.

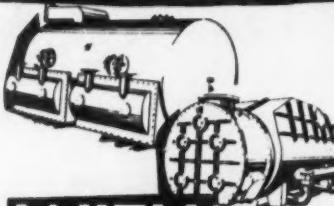
Judicial Review of Zoning Rulings

In *Brae Burn, Inc. v. City of Bloomfield Hills*, 86 N.W. (2d) 166, a 1957 Michigan case, two landowners sought judicial overruling of the refusal of the zoning board of appeals to grant them separate building permits.

Both sections of land were included in a 40-acre tract purchased by Robinson in 1951. At the time of his purchase of the tract, the land was zoned residential. A 20-room building with 8 baths was located on the land, with a substantial setback from the highway. Robinson was at that time granted a variance by the zoning board of appeals, allowing him to operate a convalescent home in this building, but conditioned on his not enlarging or adding to it.

The building and 14 acres of the tract subsequently were sold by Robinson to Brae Burn, Inc., which sought a building permit to en-

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large the convalescent home. This was refused, and the company sought to force the zoning board to issue the permit by asking the court for a writ of mandamus.

Robinson also sought a building permit that would allow him to construct a 3-story office building on another portion of the tract, which he still owned. This was refused, and Robinson also sought a writ of mandamus. The two suits were joined, and heard together.

The circuit court granted the two writs of mandamus. On appeal to the Michigan Supreme Court, however, this was reversed, and the building permits were finally denied. The higher court stated that, "(We) require more than a debatable question . . . It must appear that the clause is an arbitrary fiat, a whimsical ipse dixit, and that there is no room for a legitimate difference of opinion concerning its reasonableness . . . Save in the most extreme instances . . . we will not disturb the legislative judgment. It is immaterial that we, as legislators, would have been wiser . . . Unless . . . we have patiently a capricious and irrational invasion of property, the merits undebatable by reasonable men, the action is indefensible."

Confiscatory Zoning

Despite the above holding, which is the usual result, some courts nevertheless have held that a particular type of zoning was unconstitutional. An example of such a holding is found in *Frendo v. Southfield Township*, 85 N.W. (2d) 130, a 1957 Michigan case.

In this case, the plaintiffs owned a little more than two blocks of property fronting Eight Mile Road (the borderline of the City of Detroit and Southfield Township). This is a noisy and heavily traveled road, being used extensively by automobiles and heavy trucking. The plaintiffs' property was zoned residential. This was the only property within a 6-mile stretch along Eight Mile Road that was zoned residen-

tial. All other property on Eight Mile Road is industrial or commercial except one home fronting Eight Mile Road and 16 other homes backing on Eight Mile Road. There was no market for the plaintiffs' lots whatever as residential, and one of the plaintiffs testified that he had received no offer to purchase these residential lots for over 15 years. The lots were shown to be ineligible for Federal financing for residential building. Evidence also showed that the lots were not bought with the specific purpose and expectation of getting the land rezoned.

The Michigan court held that the zoning was unreasonable, confiscatory, and invalid, and the Township of Southfield was restrained from enforcing the ordinance and from classifying the lots more strictly than commercial.

Trailer Camp

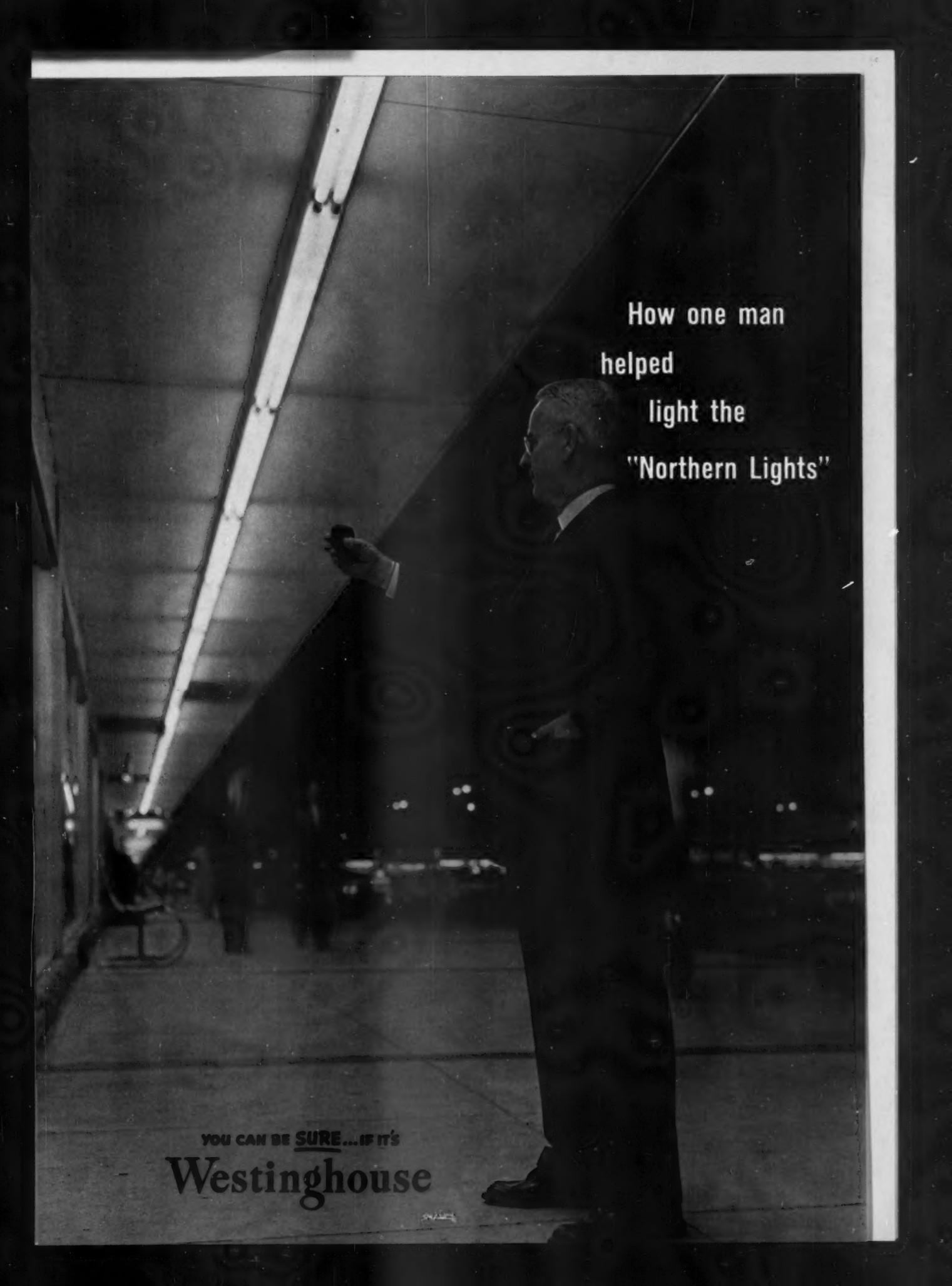
Another case in which zoning was held to be invalid was *Clark v. Joslin*, 82 N.W. (2d) 433, a 1957 Michigan case.

In this case the plaintiff's property was zoned for farming, agricultural, or residential purposes only. His 80 acres were located two miles from the nearest populated area. A railroad mainline ran through the property, and it was located in an agrarian area.

It was not shown that the establishment of a trailer camp on this property, as desired by the plaintiff, would be detrimental to public health, safety, morals, or general welfare. Consequently the court held the ordinance void, as applied to plaintiff in regard to the proposed trailer camp. □

Expert Witness Reprint

Robin Beach's five articles on "The Engineer as an Expert Witness" are available in a 16-page reprint for \$1.00. Please write to: Reader Service Dept., CONSULTING ENGINEER, 217 Wayne St., St. Joseph, Mich.



How one man
helped
light the
"Northern Lights"

YOU CAN BE SURE...IF IT'S

Westinghouse

Building—Northern Lights Shopping Center, Conway, Pennsylvania

Owner and Developer—Don M. Casto—Don M. Casto, Jr.

Architect—C. Melvin Frank, A.I.A.

Owner and Builder—Joe Skilken

Electrical Contractor—E. C. Ernst, Incorporated

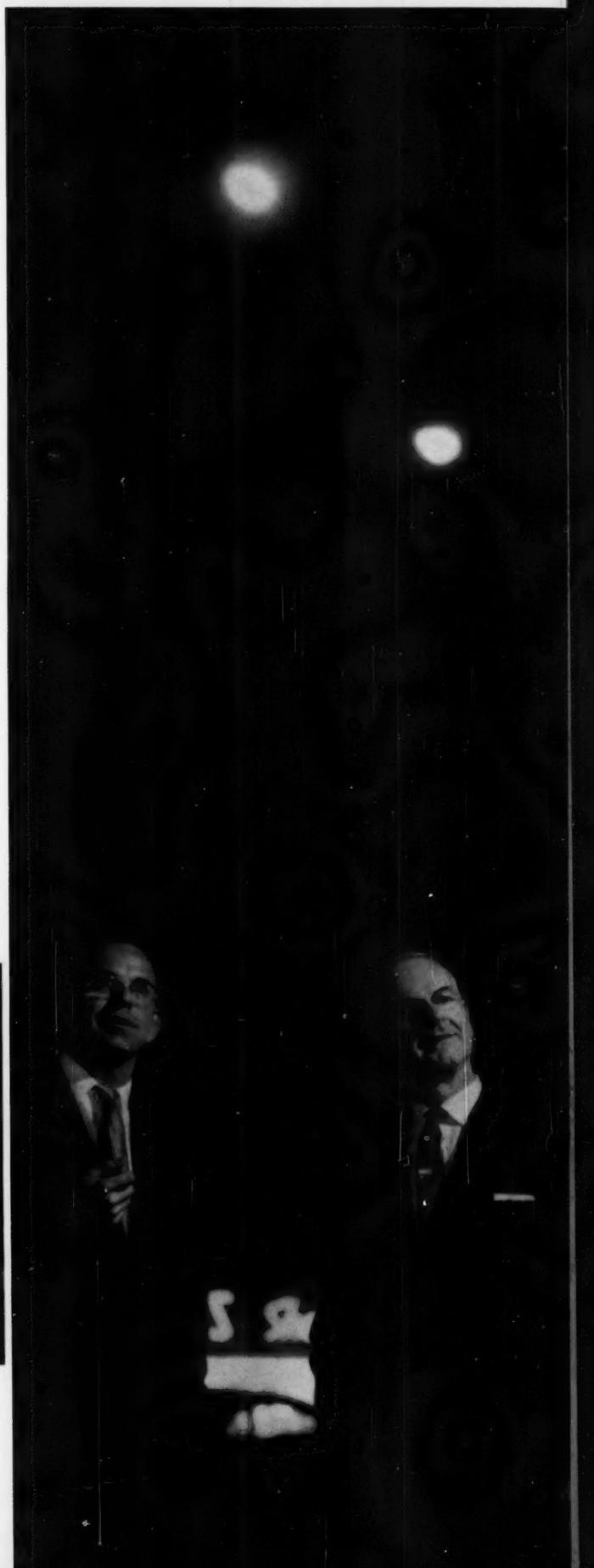
OUTDOOR—Curtis Lindberg, partner of architect C. Melvin Frank, discusses parking safety and convenience with Westinghouse lighting engineer, Ken Flint.

The brightly illuminated Northern Lights parking lot is an invitation to stop and shop. A cheery, roomy look was created with the carefully calculated use of Westinghouse luminaires. Traffic moves safely and surely. Annoying fender-bending is kept at an absolute minimum. Shoppers walk to and from their cars in complete safety.

Inexpensive, practical and attractive Slimline units light walkways. Spotlighting by Westinghouse adds dramatic touch.



TEAMWORK—Ken Flint (far right) helps iron out details of lighting system with (left to right) Joe Skilken, owner and builder; C. Melvin Frank, architect; Don M. Casto and Don M. Casto, Jr., owners and developers. Conferences were also held with prospective tenants.



Westinghouse lighting engineer helped coordinate lighting at Northern Lights Shopping Center



Your Westinghouse Lighting Engineer—Ken Flint

Behind the taken-for-granted convenience of shopping center shopping lies an unusual lighting problem. Department stores, supermarkets, specialty shops, banks, restaurants, a parking lot—each has its specific lighting requirements . . . requirements that must be taken into consideration in the over-all planning.

A HELPING HAND—In engineering the lighting installation for the Northern Lights Shopping Center at Conway, Pennsylvania, architect and consulting engineer, C. Melvin Frank, sought the best counsel and assistance available. He found it in the Westinghouse lighting engineer—a man with ideas—a man who knows lighting *and* construction. His name—Ken Flint.

DEPTH IN SERVICE—Flint got into the act early and stayed late . . . from the original proposal and writing of specifications right down to delivery and actual installation. Specifically, Flint coupled his product knowledge with Frank's architectural skill in working out lighting plans for prospective local tenants. Knowing his way around, Flint added the Westinghouse Chain Marketing representative to the team in determining the lighting requirements of the national chain stores. The versatile lighting engineer also lent his experienced hand in helping the architect design attractive, practical parking lot, walkway and floodlighting installations. One order placed through one distributor from one manufacturer—Westinghouse—wrapped up the complete lighting package.

Throughout all planning, negotiations and construction, Flint was there *when needed*. His product information and application assistance played an important part in providing proper lighting, reducing costs and speeding the job to completion *on schedule*.

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INDOOR—A bakery shop, a bank and a national auto supply chain store are indicative of the variety of lighting problems encountered in a shopping center. Each store's lighting layout was approached from the standpoint of customer and employee comfort and convenience . . . of utilizing

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Presenting Our Authors

W. A. Tripp has developed some sound ideas on how engineers can get the most out of elementary diagrams (page 86). In his present capacity as chief electrical engineer of the J. G. White Engineering Corporation, his interests are primarily electrical, but his ideas are applicable in many fields of engineering. Tripp is a graduate of M.I.T. and has been associated with many of the country's leading consulting firms since graduation in 1922. He is a Life Member of the American Institute of Electrical Engineers, a member of the American Physical Society, and is a licensed professional engineer in New York and Massachusetts. He has written many articles for publications in the United States and Great Britain.



combines a broad construction background with design experience on such well known projects as the M.I.T. Auditorium and structures on the Florida State Thruway. He is a registered engineer in Connecticut, Delaware, Illinois, New Jersey, Ohio, New York, and Massachusetts.

William T. Gay tells (page 112) how Fay, Spofford & Thorndike, Inc. went about the job of selecting an electronic computer and then getting it into profitable application quickly. With degrees in both mathematics and civil engineering, Gay is well qualified to

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administer the firm's Electronic Computation Department which came into existence about two years ago. He is presently busy programming the computer for highway and bridge design as well as promoting its use throughout



the organization. Originally an engineering undergraduate at the University of Alabama, Gay switched to UCLA where he received his degree in mathematics. Later, after three years of construction work in the Permafrost area of Alaska, he returned to the University of Wyoming to earn a degree in civil engineering. He has been with consulting firms ever since, specializing on civil engineering assignments in highway, building, and foundation design.

Robert L. Whittlesey makes a good case for electric heating (page 102), although he is careful to point out the negative factors along with the positive. He is presently the head of Whittlesey and Asso-

ciates, consultants specializing in air conditioning, heating, ventilating, plumbing, industrial process work, and associated fields. He is the author of a number of articles

in the field of heating and cooling, and has lectured at the University of Colorado and Colorado State University. Whittlesey is a registered professional engineer in Colorado, a charter member of the Consulting Mechanical Engineers' Association, and a member of the Consulting Engineers Association of Colorado. He holds a B.S. in mechanical engineering from Iowa State College and a BAAS degree in architecture from the University of Denver.

Dr. Lev Zetlin developed the portable abutment for use in laying prestressed, pretensioned pavement (page 80) while associated with B. K. Hough, consulting engineer retained by the U. S. Naval Air Station at Niagara Falls, New York. The prestressed, pretensioned pav-



ing studies were under the District Public Works Office, Third Naval District, Bureau of Yards and Docks; Captain J. G. Dodd, C.E.C., USN, Officer in Charge; Gordon Wallace, District Design Director, all under the Chief, Bureau of Yards and Docks, RADM E. J. Peltier. Dr. Zetlin is a graduate of Cornell University, and holds an M.S. as well as a Ph.D. in civil engineering. He has practiced in the field of structural engineering for over 19 years, was formerly Assistant Professor of Civil Engineering at Cornell, and is presently Visiting Professor of Civil Engineering at Manhattan College. Zetlin is a licensed professional engineer in New York and New Jersey, and is a chartered structural engineer in England. ▲

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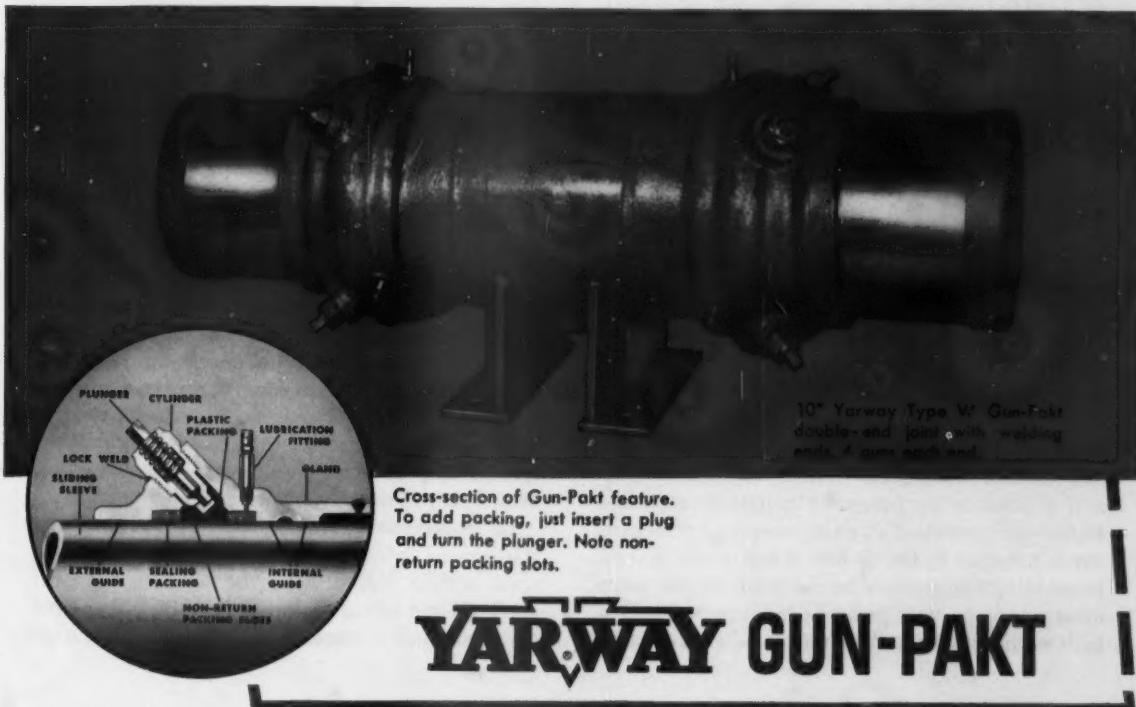
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A New Way to Pretension Prestressed Pavement

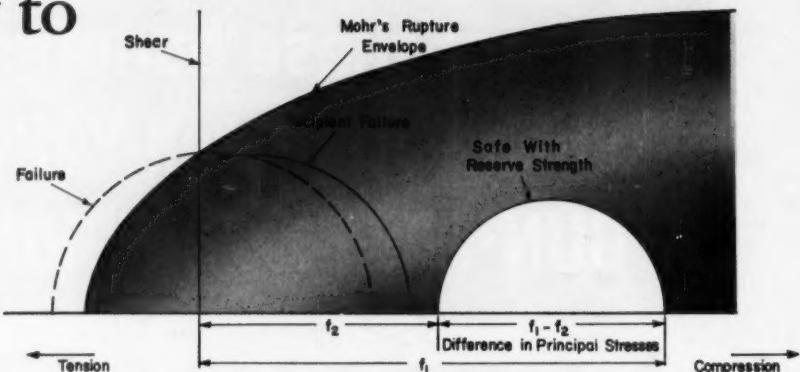


Fig. 1a—Pavement with two initial compressive stresses at right angles can resist induced tensile stresses.

DR. LEV ZETLIN, Consulting Engineer

THERE IS AN URGENT NEED for prestressed pavement for runways to meet the demands of more traffic and heavier aircraft. The principal advantage of prestressed runways is in their low maintenance cost resulting from an elimination of cracks during the service life of the pavements. Other benefits of prestressing include, in effect, an increase in the tensile strength of concrete with simultaneous homogeneity and continuity imparted to the pavement. Elimination of contraction joints and wider spacing of expansion joints, coupled with a high increase in load carrying capacity, are further benefits. For example, a 6-in. concrete slab, initially prestressed in two directions with as little as 200 psi, can carry planes with wheel loads of 100,000 lbs and still have a large reserve capacity. Prestressing also increases the resistance to fatigue.

Two-Way vs One-Way Prestressing

A pavement is essentially a plane structural member, subjected to stresses in its own plane. Stresses normal to the plane of the pavement are insignificant. Any point inside the pavement will be subjected to stresses in all possible directions in the plane of the pavement. The object of prestressing is to increase the resistance of the pavement to stresses in the plane of the pavement such as those induced by external loads, shrinkage, temperature, and humidity variations.

If a point in the pavement is initially subjected to two perpendicular compressive (principal) stresses, f_1 and f_2 , the ability of that point to resist induced tensile stresses in the plane of the pavement would be very great, as is illustrated in Fig. 1a. On the other hand, if this same point is sub-

jected to a uniaxial stress f_1 only, Fig. 1b, its ability to resist induced tensile stresses, as well as the reserve available to resist additional compressive stresses, would be relatively low.

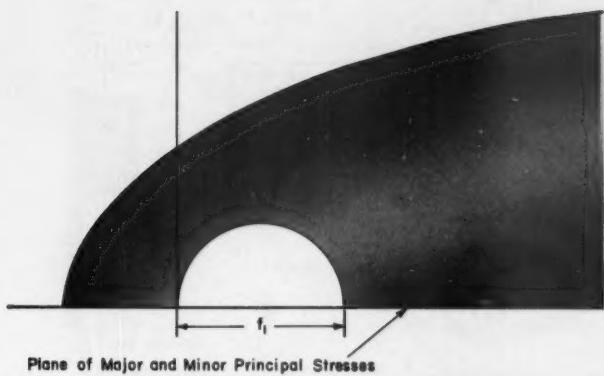
In a prestressed pavement, the prestressing stresses are locked compressive stresses whose function is to supply tensile strength to the pavement. It is obvious, therefore, that two-way prestressing is very much superior to one-way prestressing, both with respect to superimposed compressive and tensile stresses that could be set up by external factors, such as airplane or other vertical loads, thermal changes, and shrinkage.

Pretensioning vs Post-Tensioning

Theoretically, prestressing can be achieved by either post-tensioning or pretensioning. Post-tensioning is commonly achieved by inserting conduits with cables in the forms before placing concrete. After the concrete has hardened, the cables are tensioned by jacks or take-up nuts.

Among the disadvantages of post-tensioning are the loss of prestressing force through the friction between the cable and the duct and the transmission of prestressing through end anchorages only. These two factors result in uncertainty as to the amount of actual prestressing transmitted throughout the pavement. Furthermore, when a load is applied over some area on the pavement, local distortions are stabilized by the cable forces induced at the ends of the pavement.

In pretensioning, the strands are tensioned to the desired intensity first. Concrete for the pavement is then placed. After the concrete has hardened, the strands are released from their abutment, and their pull is transferred as compressive stress



Plane of Major and Minor Principal Stresses

Fig. 1b—Pavement with uniaxial stress only has relatively little ability to resist induced tensile stresses.

to the hardened concrete. Among the many advantages of pretensioning are internal stressing levels of known magnitude throughout the whole length of the strands, continuous potential bond between the strand and the pavement, and resistance to distortion under localized load on the pavement by strands in the immediate vicinity.

Post-tensioning involves imbedment of unrecoverable sheathing and end anchorages. Pretensioning eliminates the need for sheathing and makes end anchorages available for reuse. Furthermore, post-tensioning involves more labor than pretensioning. In spite of this apparent higher cost of post-tensioning over pretensioning, and although the advantages of pretensioning have been obvious to many designers, post-tensioning has been used almost exclusively in all attempts at prestressing pavements. The reason for this has been the high cost of abutments, which are necessary to pretension the strands prior to the placing of concrete. The cost of abutments, which ordinarily are anchored into the ground, has been greater than the extra cost of the sheathing, the end anchorages, and the extra labor of tensioning cables. Moreover, abutments anchored to the ground frequently have a tendency to yield and lose tension.

With a stable, portable abutment, not tied to the ground, all of the advantages of pretensioning could be realized. On projects requiring large areas of prestressed pavement, where there would be significant reuse of abutments, their cost per square foot of pavement would become insignificant.

Theoretical Principle of Portable Abutments

With portable abutments, pavement can be constructed in sections, with necessary gaps between

sections filled in later. With a method for imparting continuity between the main sections through the gap, the portable abutment could be used to construct pavements of any desired length without joints. The portable abutment, as shown in Figs. 2 through 6, derives its strength from the pretensioning strands required for prestressing the pavement. It is essentially a closed curve in plan.

Since it is characteristic of a closed curve that any change of length in one chord induces changes in the length of other chords, a decrease in the length of one chord diagonal will induce an increase in the length of other chord diagonals. Thus, when pretensioning strands are placed longitudinally and transversely, as one set of transverse wires is being tensioned, tension is produced in all other strands. This stabilizes the abutment against deformation. When all the strands have been tensioned to the desired level, the closed ring of the abutment is in compression. This structural principle results in economical construction.

Within the abutment, curved or rectangular pavements and slabs can be prestressed in two directions. Prestressing transmitted by pretensioning is equivalent to locked internal stresses and hence there will be no bending or rotation in the pavement or slab inside the abutment.

The Portable Abutment and its Operation

The portable abutment was developed in connection with design studies for a prestressed taxiway for a U.S. Naval Air Station. Although the system has not yet been used, design and construction procedures have been rather thoroughly developed.

In placing main sections of pavement, the closed ring of the abutment is erected on site from short units, as shown in Fig. 2. The abutment could be of any size to accommodate any desirable width or length of pour for one section of a pavement. The larger the abutment is in plan, the heavier becomes the cross section of the closed ring. For large projects it may be desirable to construct a number of abutments to speed up the construction.

Fig. 5 shows an abutment that would accommodate a 50- by 160-ft pavement section. The ring is built from high strength steel structural sections, or from rails which can be procured economically. For the pavement shown, the cross section consists of 60 sq in. of steel stressed at 50,000 psi.

Pretensioning strands are in clusters. This arrangement results in an easy pretensioning procedure and permits placing of conventional paving formwork as shown in Fig. 6. Paving operations are conventional and do not detract from a uniform imposition of prestressing to the pavement.

Auxiliary systems of cables are attached to the underside of the abutment as shown in Fig. 3. This

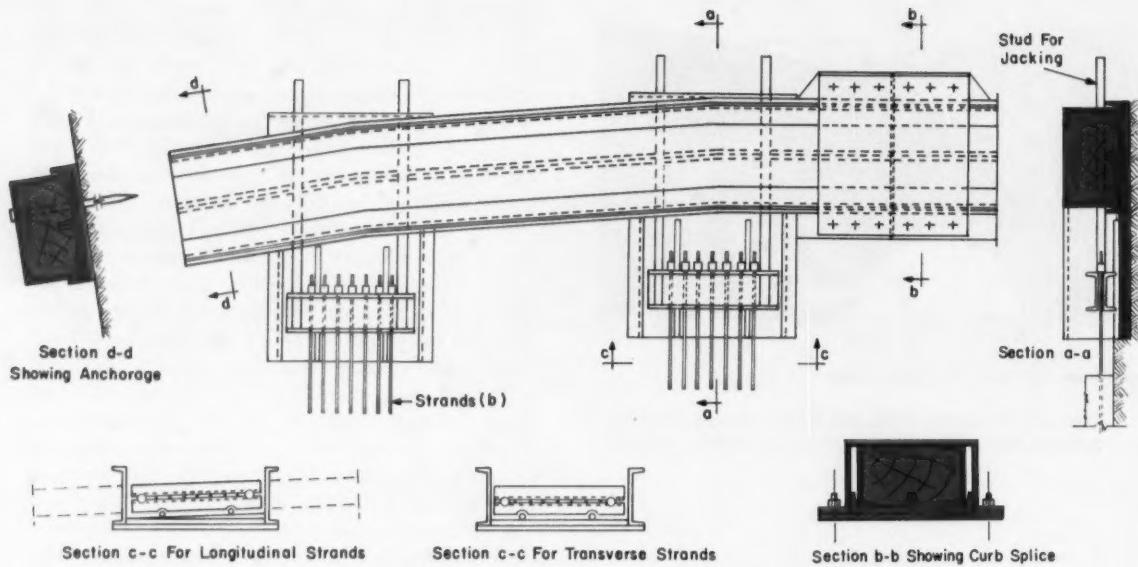


Fig. 2—Details of portable abutment designed for use on pretensioned, prestressed pavement projects.

auxiliary system serves a dual purpose. It stabilizes the abutment against vertical deformations out of the plane of the abutment, and it supplies excess tension above the pretensioning force in the main system of strands. The tension in the main system of strands is controlled by the amount of pre-stressing per linear foot required for the pavement, both transversely and longitudinally. The desired transverse and longitudinal forces are not necessarily equal. Whatever the desired forces for pre-stressing of the pavement, they may not coincide with the transverse and longitudinal forces neces-

sary to stabilize the abutment. The additional forces necessary for stabilization are supplied by a system of auxiliary cables, which are placed beneath the pavement and left there after their release from the abutment.

For proper stabilization of the abutment, the jacking of the clusters of strands has to be performed in a prescribed sequence. As an example, in the abutment shown in Fig. 5, eight jacking crews could prestress all strands shown.

The two parts of the longitudinal strands (a) for the gaps shown in Fig. 7 are anchored in the

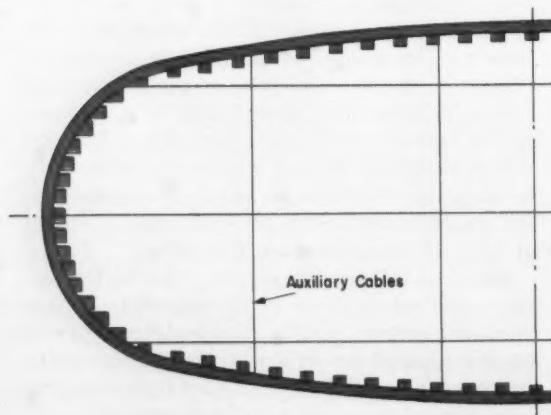


Fig. 3—Portable abutments form closed ring which is dimensionally stabilized by auxiliary tension cables.

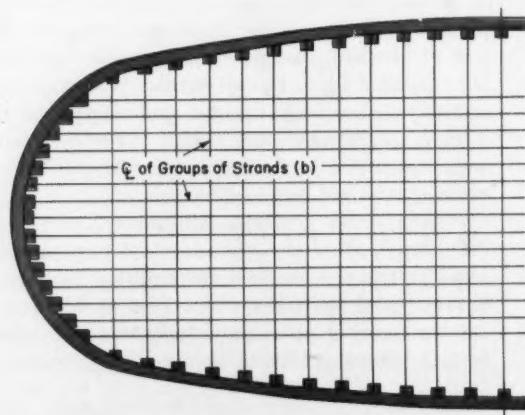


Fig. 4—Groups of pretensioned prestressing strands are held in take-up assemblies attached to abutment.

main sections before the pouring of these sections. To effect continuity in the application of the longitudinal prestress through the gaps without impairing the previously constructed main sections, a definite procedure must be followed.

After the strands have been tensioned, the precast concrete blocks shown in Figs. 5 and 8 are laid over the strands along a curved line, as shown in Figs. 5 and 7. They are laid over a curved line in order to eliminate the excessive tensile stresses at the edge of the concrete pavement between the shoulders that would be created by the abutments spanning the gap.

The sides of the precast blocks are lined with tar paper or similar material to prevent bonding of concrete to them. Strands (a) are imbedded in the pavement portion (A), Figs. 5 and 7, between the precast blocks and the gap. These imbedded strands comprise the two halves of longitudinal strands that are used for prestressing of the gap and for providing continuous prestressing across the gaps. The entire concrete section, shown in Fig. 5, is then paved.

At this stage strands (a) are without stress. Now that the main section of pavement is complete and the abutment removed, the following state of stress exists:

¶ Longitudinal stress in the concrete is constant (disregarding the effect of subgrade friction, which is not important for the purpose of this discussion). ¶ The longitudinal compressive stress is transmitted to the concrete from the longitudinal strands (b) through bond stresses which are developed and concentrated within a few inches at the ends of the strands. Otherwise, the bond stress is zero throughout the whole length of the strands. The

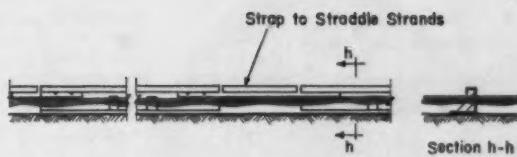


Fig. 6—Strap is used to straddle groups of strands, allowing standard forms to be placed between them.

zone of bond stress, therefore, is located within block (A) of the pavement. Thus, the tensile force, say, P lb, in the longitudinal strands is constant throughout the whole length of the strand, including the short length which crosses the precast blocks. Longitudinal strands are not bonded to the precast blocks, but pass through them freely. ¶ Precast blocks are compressed by the hardened concrete pavement on each side.

A few component units of the portable abutments are now placed between the main sections for pouring and prestressing of the gap. Strands (a) in the gaps are tensioned, and the gaps filled in with concrete. Details of prestressing of the gaps are illustrated in Fig. 7. Abutments are connected to, and rest against shoulders constructed for this purpose in the main sections.

When the longitudinal strands in the gap are tensioned, the following state of stress exists in the main section:

¶ As strands (a) are pulled, the pull is transmitted by bond to block (A), Figs. 5 and 7. Since block (A) is unbonded to the precast blocks, compressive stress on the precast blocks is gradually reduced. The compressive stress throughout the main section of pavement is, however, unchanged, since what-

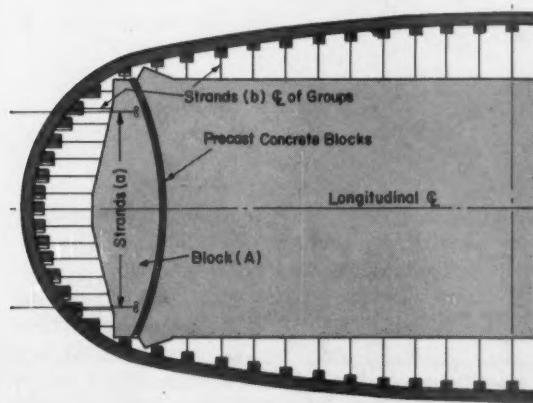


Fig. 5—Section of pavement is poured with precast blocks separating Block (A) from longer main slab.

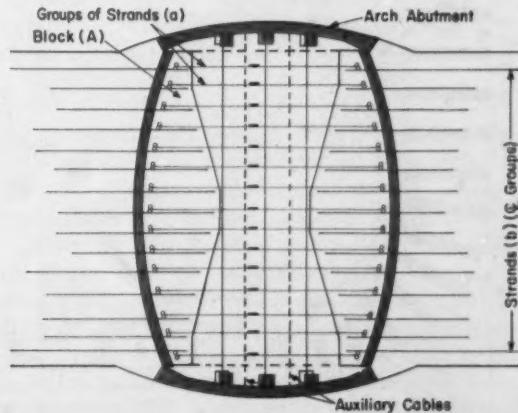


Fig. 7—Prestressing of pavement gaps is facilitated by arching abutments against shoulders in main slab.

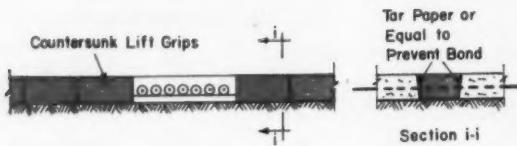


Fig. 8—Precast blocks can be removed after gap strand tensioning has created continuous stress.

ever tension is imposed on strands (a) is transmitted as a compressive reaction by the arch-abutments to the main section at the shoulders.

¶ As strands (a) are pulled, the tension in strands (b) crossing the precast blocks, hardly varies since the change of stress takes place essentially between the precast blocks and the hardened concrete. When strands (a) are tensioned to P lb [the same longitudinal stress as in strands (b)] the resulting change of stress in the short length of strands (b) crossing the precast blocks is limited to less than 2 percent. ¶ As the compressive stress in the precast blocks is relieved, they are removed, leaving an 8-in. groove in the pavement. This groove is cleaned and grouted at the same time as the gap between consecutive main sections is paved.

¶ During tensioning of strands (a), the main section of pavement shown in Fig. 5 does not tend to move. The movement of block (A) is very small. It is equal to the elastic deformation of the 8-in. wide precast block.

¶ When the concrete in the groove and in the gap has sufficiently hardened, strands are cut off the arch-abutments. Prestressing is thus transmitted im-

mediately to the concrete in the gap and also to the block (A).

The described process imparts continuous prestressing between two consecutive main sections. By successive or simultaneous operations, this process could be used to impart prestressing to any desired length of pavement without causing any impairment to the state of stress or the bond in the hardened concrete.

Application of the Portable Abutment

The jet taxiway design shown in Fig. 9 has a pavement that is 6 inches thick. The concrete has a 5000 psi strength at 28 days. The coefficient of subgrade reaction was taken as $K=300$. For construction sequence, the taxiway was divided into sections as shown in Fig. 9. The pavement was designed for 100,000 pounds dual tire landing gear with a tire pressure of 200 psi. Expansion joints were located as shown in Fig. 9, with the largest distance between any of the expansion joints limited to about 100 feet.

Additional considerations were stresses set up of the prestressed pavement. They include permanent losses due to shrinkage of concrete, creep of concrete, relaxation of steel, and possible temperature differential which could exist between the strand and concrete at the time when the concrete is poured.

Additional considerations were stresses set up in the pavement by wheel loads, seasonal temperature variations, bond between the strands and concrete, and subgrade friction during the transfer of prestress.

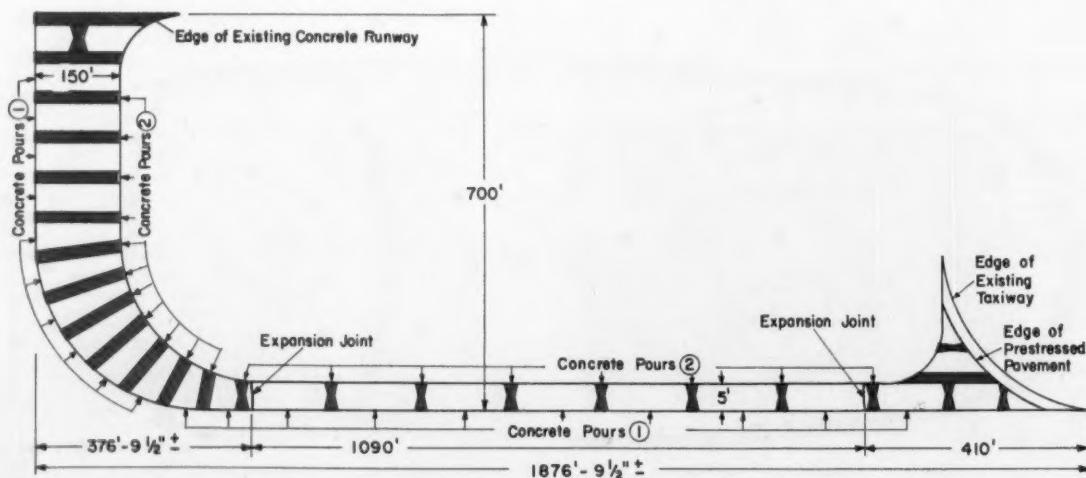


Fig. 9—Plan of taxiway shows proposed method of pouring concrete for main slab sections and gaps.

Fig. 10—Wide pavements can be poured by arranging portable abutments in position shown. Pouring sequence would be identical to that for narrow prestressed slabs, as in Fig. 5.

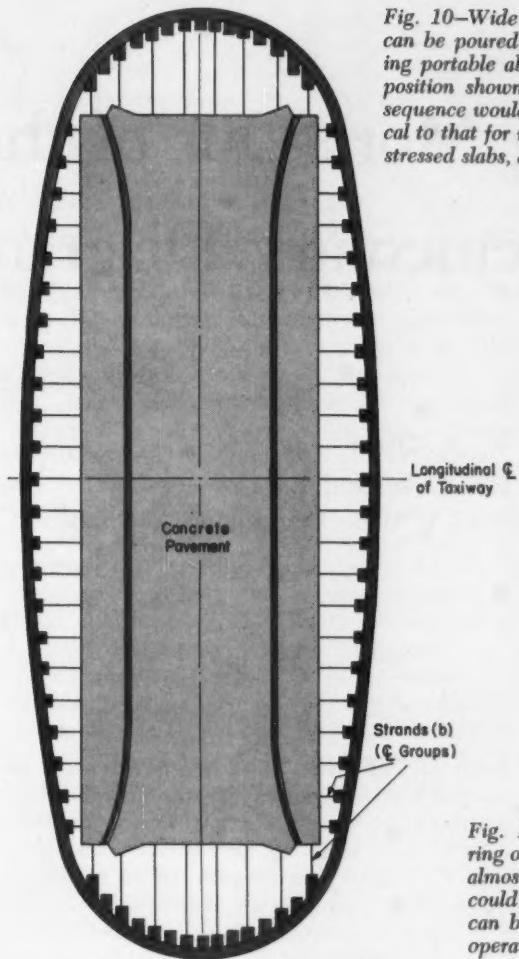
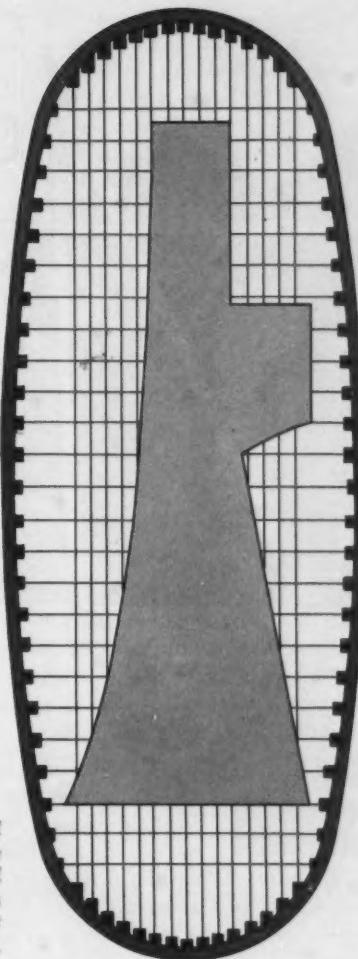


Fig. 11—Within closed ring of portable abutments almost any shape desired could be poured. System can be utilized in precast operations or on job site.



The design data were as follows:

Flexural Strength	700 psi
Modulus of Elasticity	
of Concrete	4×10^6 psi
Temperature Variation	100 F
Assumed Subgrade Friction	0.7
Shrinkage Coefficient	0.0004
Creep Factor	2

With the above data, total losses in the tensions of the strands would amount to about 33,000 psi. The required initial prestress, including the losses, would amount to 740 psi longitudinally and 316 psi transversely. This would require 7/16-in. diameter strands placed 2.82 per foot longitudinally and 1.2 transversely.

The design was based on a rather conservative coefficient of subgrade friction. Pavement floating tests performed by B. K. Hough in connection with the same project indicated that with flotation, the

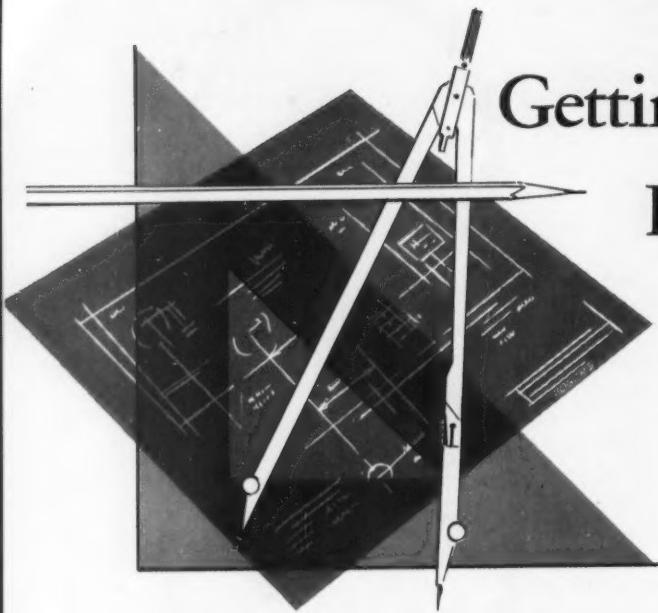
coefficient of subgrade friction can be substantially reduced. With the reduction in the coefficient of subgrade friction, the amount of longitudinal pre-stress can also be considerably reduced.

Future Applications

By turning the abutment in Fig. 5 at 90 degrees with respect to the longitudinal axis of a runway, the same abutment could be used to pour and pre-stress 150-ft wide sections, as shown in Fig. 10.

A portable abutment of reasonable dimensions could also be used on wide runways, which are usually 300 feet wide. In this case, the width of the runway could be constructed in several consecutive sections in a manner similar to that shown in Fig. 10.

The portable abutment could be efficiently used on highways and in precasting plants to pre-stress slabs of any shape, as shown in Fig. 11. Such slabs commonly require two way prestressing. □



Getting More Out of the Elementary Diagram

W. A. TRIPP

Chief Electrical Engineer

The J. G. White Engineering Corporation

THE ELEMENTARY (schematic) diagram is both a medium of intelligence and a tool. Like any drawing, it serves to convey intelligence from the originator to the user. Within the originating organization it serves as a tool in making other drawings, such as equipment wiring diagrams or cable and conduit schedules. Some recent developments, involving a little attention to detail and a little effort in organizing method, have shown, it is believed, substantial results in increasing the effectiveness of elementary diagrams in both respects.

Faults in Communication Processes

Perhaps the three worst faults affecting the conveying of intelligence are: inconsistency, incompleteness, and inexactitude. Usually elementary diagrams will exhibit all three of these faults in varying degree. Improvement is naturally of prime interest to the recipient but also will pay substantial dividends within the originating organization. The consulting engineer is concerned with this problem at both ends, for he receives many elementary diagrams from equipment manufacturers, and he also produces many of his own as he develops plant processes.

The Language of Elementary Diagrams

As might be expected with a unique medium of communication, elementary diagrams have a lan-

guage of their own. This language has been developed by the electrical industry on a broad yet detailed basis, and it is in fairly common use. However, it leaves some latitude for individual expression. As a result, the recipient of an elementary diagram has a problem not only of language but, to a degree, of individual idiom or vernacular.

We have attempted to rationalize the use and detailed format of the language of elementary diagrams on a basis that establishes patterns that can be followed easily in the making of the diagrams and will be readily apparent to the user. This includes a complete directory of the symbols and other cryptology, a full description of all pertinent features of devices, and any other information necessary to an understanding of the diagram. In this work the industry standards and common practices have been used as much as possible. However, where there seemed to be substantial room for greater clarity or other improvement, we did not hesitate to take an independent approach.

Symbols

Symbols are a basic component and are handled easily, for we have ASA Standard Y32.2, which covers them thoroughly. However, this Standard allows many alternates. Therefore, instead of adopting the Standard and leaving it to the user to recognize the particular alternate, our diagrams include a legend of symbols. This procedure is helpful

in instances where it becomes necessary to devise a special symbol.

Closely akin to symbols are abbreviations and other identifying marks. Any cryptic items of this nature are explained in an appropriate table or descriptive note.

Nomenclature

Nomenclature also is basic, and, up to a point, easily handled, for we have ASA Standard C37.2. However, C37.2 differs from most other industry standards in that it is not a technical standard at all, but an attempt to unify usage. It is, in fact, a formulation of the language of diagrams.

In adopting any formulation of this type, many usages that are not ideal are included. But to change too radically and abruptly creates more confusion than it eliminates, so we adopted the Standard Device Function Numbers of C37.2 with only minor variations. For example, it has seemed more useful to employ familiar initials indicative of the nature of the device, such as PB for pushbutton station, CS for control switch, and SS for selector switch, in place of the respective function numbers.

The Standard seems to endorse this sort of substitution, for in the typical elementary diagram and explanatory data shown on pages 20 and 21 of C37.2, the control switch is designated as 52CS. However, it is suspected that this apparent endorsement is more by accident than design, as the control switch has been included with a group of breaker devices. This designation is common in some quarters but is not the best. This control switch is not a part of the 52 device, probably being quite remote. It merely controls the 52 device, which can be clearly seen from the diagram.

Our procedure, assuming a vertical sequence of devices in drawing the diagram, is to place the identification of the device to the right of the symbol, and any other more detailed designation, such as contact numbers, to the left. This follows general practice, but some differences in detail handling begin to appear. One feature of our program is to arrange the identification nomenclature on the right so that it uses only a single line, and contains all the characters, but only those, specific to the device identified. The limitation to a single line has not been found to work a hardship, and it has freed the area of the second line so it can be used, if desired, to designate the machine or equipment to which the device applies. Usually the second line is filled in only when the device applies to a machine or equipment other than that for which the diagram is drawn. This makes foreign components stand out helpfully in the diagram.

Standard 37.2 leaves rather wide choice in the meaning assignable to second line characters. Typi-

cal of this are the following, used in the elementary diagram referred to previously: CC, TC, and LC for specific components of the breaker control mechanism; aa for a particular kind of auxiliary contact; and M and A for functional operation of contacts. It is felt that this unnecessary freedom is not conducive to uniformity in design in the originating group nor to ease of understanding by the user. Incidentally, the use of M and A is plain redundancy in view of the development included for device 43.

Device Details

One of the requirements set up for our program is that the information given on each device cover the construction, operation, and application to such extent and with such exactitude as to eliminate all doubt in understanding. Important facts which "everybody knows" are not to be left out. Unclear matters, if important, are to be ferreted out.

Normal sources of information for the design office are catalogs, engineering data books, manufacturer's prints, and instruction books. The man in the field depends on these also, as he is not free to tear everything apart to see how it works. Sometimes these sources of information are incomplete or foggy, and considerable effort is required to develop what is needed. On one of our projects, for example, a number of timers were used in the purge system of some large boilers. The usual sources of information were not fully comprehensive or clear in their coverage of this item, and it took considerable effort to get the necessary details.

On this project, the timer had a motor-driven timing mechanism having contacts variously circuit-opening or circuit-closing at adjustable settings of the timer cycle. An electromagnetically operated clutch engaged the timing mechanism to the motor. The motor, if energized, would run free if the clutch was not energized, and would drive the timing mechanism when the clutch was energized. The end of the timing cycle was determined by the operation of a contact which opened the circuit to the drive motor, thus stopping the travel of the mechanism. The timer would hold this timed-out position just so long as the clutch remained energized, and would spring-reset to the starting position when the clutch was de-energized. There was also obtainable a contact which was actuated by the clutch mechanism.

We found that the information required for a fully understandable explanation of this device on the drawing consisted of a description containing 69 words, a multiple development with one part giving a bar chart of contact position in relation to timer travel and one part tabulating contact position with respect to clutch position, and a

Timer Relays, Adjustable Motor Driven Timer With Clutching-In Contactor; Motor Runs Free If Energized But Not Clutched In; Timing Mechanism Operates Only When Clutched In And Motor Is Energized; Timing Mechanism Stays in Timed Out Position (Timing Cycle Completed) After Completing Cycle Until Contactor Is De-Energized, Then Is Spring Reset To Starting Position. Have "T" Contacts (Operated By Timing Mechanism) And "S" Contact (Operated By Clutching-In Contactor) Which Operate As Follows:

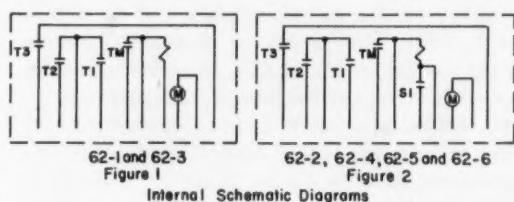
Ref. Fig.	Device Number	Contactor Action			Timer Action	
		Contact Number	Contactor De-Energized	Contactor Energized	Contact Number	Timer Travel
Fig. 1	62-1 62-3	None			T M T I T 2 T 3	
Fig. 2	62-2	S I	Open	Closed	T M T I T 2 T 3	
	62-4 62-5 62-6	S I	Open	Closed	T M T I T 2 T 3	

 = Contact Closed 5 Seconds 5 Minutes Hold Until Reset

Fig. 1 — A description, multiple development including bar chart, and wiring diagram of timer relay circuit.

thumbnail sketch of the wiring diagram. This composite arrangement is shown in Fig. 1.

In another power plant, involving a simple timer used on a coal sampler, it appeared that there must be a contact that would prevent jamming under conditions of unusual operation. One of the requirements of good control design is to prevent damage or dangerous conditions in the event of malfunction of equipment or a mistake by an operator. The data sheets on the timer were not definitive. Neither the coal machinery manufacturer, supplying the sampler as a component, nor the sampler manufacturer could clarify the mat-



ter. Fortunately, an actual sample of the timer was located in the office of the representative of the timer manufacturer, and the facts were determined by actual inspection. A full description was accomplished with the diagram shown in Fig. 2.

Problem With Relay

An interesting condition developed recently when a field-failure relay was added to the protective system of a turbine-generator. The relay failed to function properly. The cause seemed elusive but finally was found to involve the polarity of the instrument transformer connections. The current transformer connections provided for the original instrumentation apparently had been reversed in the field to agree with the instruction manuals, but the change had not been recorded on the job drawings. Actually, the instruction manual for the field-failure relay was drawn for oppositely connected current transformers. The connections for the field-failure relay were made to agree with the manual for that relay and the record prints. It was not until the disagreement between the two sets of manuals was noted that the possibility of a field change was realized. To check completely, a machine outage had to be arranged and a polarity check of the current transformers run. This confirmed the field

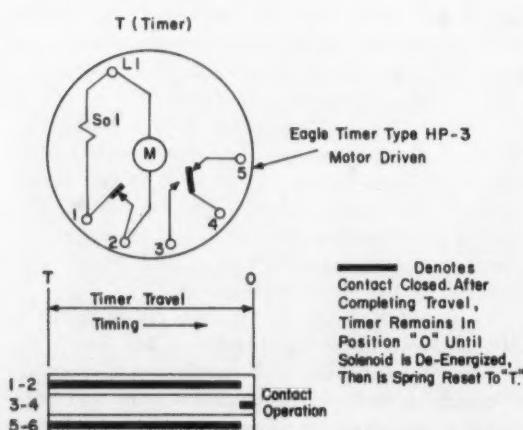


Fig. 2 — Elementary diagram of a simple timer on coal sampler. Contact 1-2 is the "hidden" contact.

change. The confusion stemmed from the difference in the way current transformer connections were drawn in two different instruction books.

Even the ordinary overcurrent relay can give trouble. The bothersome point in connection with this device is the coordination of the target coil with the characteristics of the external d.c. circuit. This is typical of the target coil of many relays. To save work and much repetition, we did not show the complete details of the overcurrent relays on our diagrams for a while, and a simplified description was used (Fig. 3). While results were reasonably good, it was found that there is no adequate substitute for full treatment. We now use the diagram shown in Fig. 4.

These are some of the ways in which information is required, often to permit developing a correct circuit in the first place, but certainly to convey a full understanding of the circuit to others.

Descriptive Data and Methods

The specific requirements of some of the commoner devices are to some extent included in ASA Standard C37.2, and we have made an effort to adapt them. However, we have made some important departures. We also have developed a pattern for the treatment of these devices. Regardless of the nature of the device, much of the needed information about it will fall under certain general classifications, while the methods of presenting or portraying it also will be classifiable. The following subject headings will be found useful, though not all devices will require treatment under each heading, and for some devices the method of treatment automatically combines two or more headings:

¶ Identification: Under this classification, the nature of the device should be given. We assume that the nomenclature identification already has been stated, and then simply provide amplification.

¶ Application: This is not required for devices whose location, either physically or functionally, is self-evident from the diagram, or not necessary to its understanding. It is necessary for position switches, sensing devices, and items of that nature.

¶ Operation: Practically all devices must be covered under this heading. Sometimes in a weak treatment a feature will be implied. Thus, with relays instantaneous action is assumed if a time action is not stated.

¶ Face appearance: For devices that must be manipulated by an operator, such as control and selector switches, this detail is important. It has no significance for most other devices.

¶ Contacts: Their number and action will be involved in most devices.

¶ Development: Sometimes the details will be so voluminous or complicated that mere words become

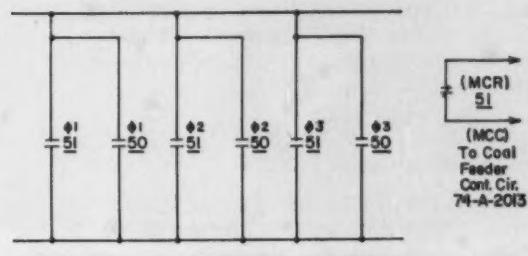
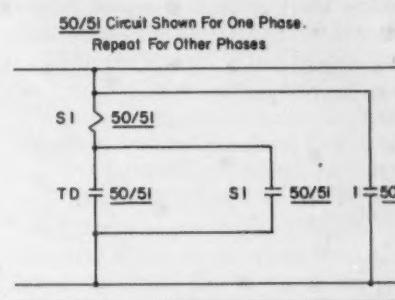


Fig. 3 – A simplified arrangement – originally utilized to save work and repetition—showing overcurrent relays.



50/5I – Combined Instantaneous And Inverse Time Overcurrent Relay. Instantaneous Section (SI) Acts on Adjustable Excessive Coil Current, Having N.O. Contact, Instantaneous Pickup and Dropout. Inverse Time Section (TD) Has Adjustable Current and Time Settings, N.O. Contact, Variable Time Closing According To Excessive Coil Current - Time Relation, Instantaneous Opening. Seal in Section (SI) Has N.O. Contact, Instantaneous Pickup And Dropout. Equipped With Indicating Target.

Fig. 4 – This overcurrent relay diagram, now used in place of that shown in Fig. 3, gives better results.

inadequate, and amplification becomes necessary. Typical are the tabular form with "X" indicating contact closed, much used for control and selector switches, and the bar-chart, for position switches.

¶ Diagram: Further details may require the use of a thumbnail sketch of contacts and internal connections. This is an excellent means of indicating whether or not contacts are electrically independent. Some manufacturers will list the number of contacts available in a device, but they have an annoying habit of failing to make them electrically independent and forgetting to mention this in their descriptive literature.

These classifications still do not include many features that must be properly specified before a particular device can be purchased. Items such as voltage and current ratings, type of enclosure, or method of mounting or attachment also must be covered, but they are not pertinent to an understanding of the diagram. Those listed are the features of prime significance. Just how they can be handled on devices which occur with frequent

regularity is evident in the examples covering push-button stations (Fig. 5), instrument switches (Fig. 6), position switches (Fig. 7), cell switches (Fig. 8), switches actuated by sensing devices (Fig. 9), and relays (Fig. 10).

Supplemental Notes

Much of this descriptive system can be controlled by appropriate attention to procedures used in the design group. However, the user must know something of intent and method, if he is going to fully understand the diagrams. This leads to the inclusion on the drawings of some description of method. This has taken the form of a group of basic notes on the information sheet of each group of drawings. These notes have changed as our experience has accumulated, and probably are still not perfect. The latest form to which they have evolved is shown in Table 1.

While most of Note 1 is self-explanatory, it should be noted that the procedure described in 1(d) is not a basic part of the nomenclature system but is the result of economy measures in connection with repetitively used diagrams. A single diagram is used where possible for a multiplicity of items of equipment, with appropriate references. However, sometimes related equipment becomes involved, the combination of which must be set forth. This happens frequently with interlocked equipment. Thus, certain induced and forced draft fan drives and dampers will form related groups, or certain pumps and valves will be interlocked. The one diagram can be used in these instances if the

variation in identity is systematically indicated. The method in Note 1 (d) was devised to do this.

A particularly good example is the wiring for the furnace pilot torches for a large boiler. There may be several tiers of burners, with a burner in each of the four corners of each tier. By keying the part nomenclature to the corner and tier identifications, a single diagram and table can represent the wiring of all pilot torches (see Fig. 11, pages 94 and 95).

Note 2 applies to plant geography, which requires further explanation.

Note 3 is merely a matter of definition on a point where two practices exist, in order to leave no doubt which is used. It is felt that the choice indicated is in the interest of the consulting engineer, whose concern is mainly the co-ordination of the wiring with the front of panel appearance and the description for purchase.

Note 4 deals with a matter of exactitude in connection with a concept which can readily get out of hand. This note not only is specific in regard to the interpretation to be placed upon the word "normal," but is restrictive as to the extent of its use. This is a much more conservative stand than that implied by some C37.2 recommendations. We feel that clarity is served better by being conservative than by resorting to artificial definitions.

Significance of Terminology

It is only by subjecting each phrase and expression used, indeed subjecting each word, to a critical and searching scrutiny that clear and unambiguous statements evolve. The description "Relay set for

TABLE 1

Note 1. Device parts are identified as follows:

- Numbers or letters to right of symbols, above line, are device identifications. Numbers correspond to device function numbers in ASA Standard C37.2 - 1956. Where letters are used instead of numbers, see appropriate legend or development. Numbers added after hyphen, where used, distinguish different devices of the same type in diagram.
- Identifications to right of symbols, below line, signify machine or equipment of whose system device is a component. This is omitted for device parts shown in diagram for system of which device is a component, and application is self-evident. A device is never considered a component of more than one system.
- Numbers or letters to left of symbols, where used, designate specific contacts or other elements of devices.
- Where a special mark replaces any part of a device identification in repetitively represented circuits, substitute the letters or numerals indicated by appropriate table.

Note 2. Letters in parentheses above device identifications are location designations. See location legend.

Note 3. In switch developments, arrangement of positions corresponds to front view of escutcheons. "X" indicates positions in which contacts are closed.

Note 4. The "normal" position of control contacts pertains only to the following devices, with meanings as indicated:

Item	Device	Meaning of "Normal"
(a)	Magnetically operated devices	Magnetic element not energized
(b)	Auxiliary contacts on switching devices having main contacts	Main contacts open
(c)	Thermal overload devices	Device not tripped
(d)	Locking-out relay	Relay set for normal running

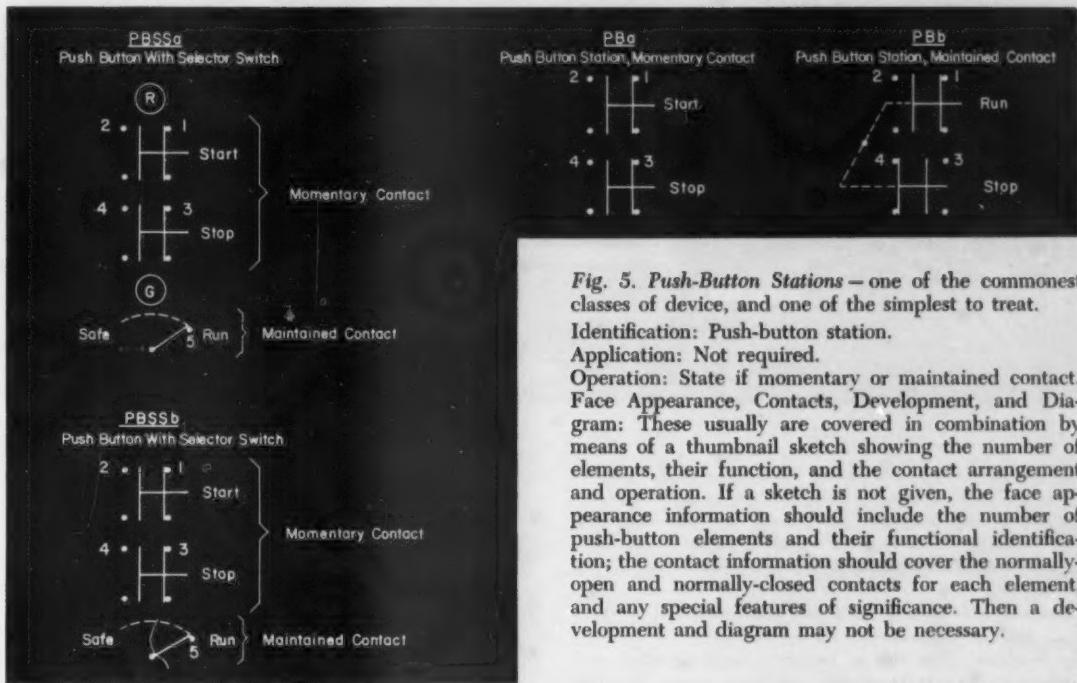


Fig. 5. Push-Button Stations — one of the commonest classes of device, and one of the simplest to treat.

Identification: Push-button station.

Application: Not required.

Operation: State if momentary or maintained contact. Face Appearance, Contacts, Development, and Diagram: These usually are covered in combination by means of a thumbnail sketch showing the number of elements, their function, and the contact arrangement and operation. If a sketch is not given, the face appearance information should include the number of push-button elements and their functional identification; the contact information should cover the normally-open and normally-closed contacts for each element, and any special features of significance. Then a development and diagram may not be necessary.

Fig. 6. Instrument Switches — another large group of devices, including control switches and selector switches. Identification: State what variety of switch it is, such as control, selector, ammeter, voltmeter, and the like. Application: Not required.

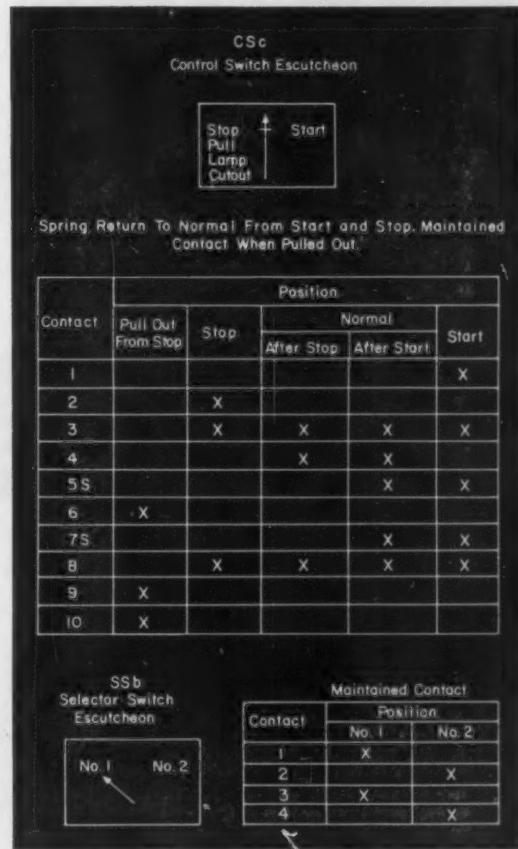
Operation: State whether maintained contact or spring return to some normal or neutral position. Number of positions must be indicated, but this is best done by a development.

Face Appearance: The functional name and location of the handle throws must be indicated. For this a thumbnail sketch of the escutcheon is very effective. Contacts: Number and operation in relation to switch positions must be given; also any special features. These are best given by means of a development.

Development: The usual tabular arrangement by contacts and switch positions, with the "X" for contact closed, seems to be the most effective. This can be arranged to accommodate most of the usual variations, such as a pull-out position, or slip contacts that differ in position depending upon the most recent action.

Sometimes it is important that there be an overlap between the closed positions of some contacts in going from one switch position to another. This can be vital in the case of some transfer arrangements. This should be stated or shown somehow. Recently coming into favor is an elaboration of the development in which a narrow column is provided for the transition between switch positions, with the usual use of "X." This effectively shows any overlaps.

Diagram: Generally not required. However, in some makes, in which paired contacts are not electrically independent, a representation of the contacts and interconnections for each "stage" should be included as part of the development.



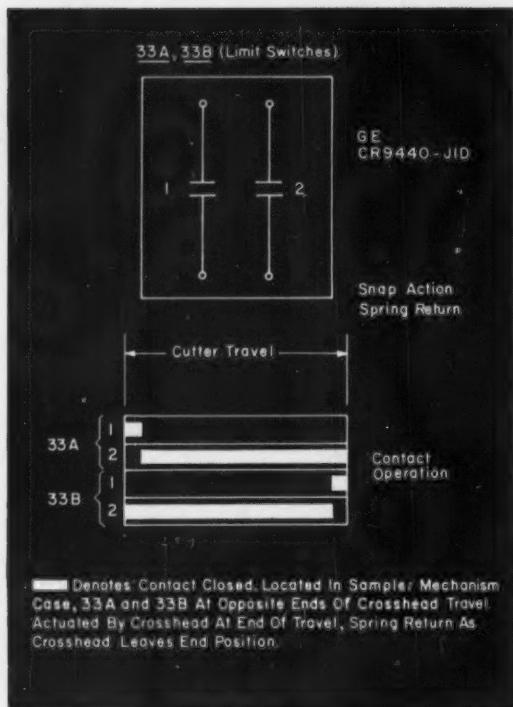


Fig. 8. Cell Switches — devices in common use on draw-out switchgear. Cell switches are really a special case of position switch relating to the position of the draw-out element and are to be distinguished from the usual auxiliary contacts on the breaker itself. It is better to treat them as position switches rather than as auxiliary contacts using an overdeveloped series of letters within the purview of Section 2-9.4.4.2 of Standard C37.2. Usually there are three switchgear positions that are significant, these being "racked-in," "test," and "withdrawn." Thus, there are six permutations which are significant with respect to the open and closed positions of each contact — and usually there are a number of contacts. A clear word picture would be voluminous and difficult to keep in mind while reading a diagram. A tabular development is a good solution.

Identification: Cell switch.

Application: State what switchgear unit each switch is located in.

Operation: Covered by development.

Face Appearance: Not required.

Contacts: Covered by development.

Development: Provide a tabular development similar to that used for instrument switches. For each position of the switchgear element the open or closed position of each contact should be indicated, using the "X" for contact closed. Indicate contact overlap if significant.

Diagram: Not required.

Fig. 7. Position Switches — An extremely common device ranging from the simple travel limit switches frequently used on valves to switches which are involved in very complicated machinery.

Identification: This frequently relates to the function of the switch, and can be quite individualistic.

Application: Must indicate machine or item of equipment to which it applies. Sometimes the detailed point or method of attachment is significant and under this circumstance it must be stated.

Operation: Usually significant only if it involves some special features, as, for instance, a magnetic latch release, a manual reset requirement, or the like.

Face Appearance: Not required.

Contacts: Their number and position with respect to governing machine position or operating cycle must be stated. Frequently this can be done with words, but if there is the least tendency for it to become unclear or too voluminous, resort should be had to a development. **Development:** This may take different forms, depending upon the switch itself and the machine or operating cycle involved. However, one of the most suitable would be a simple bar chart, the length of which is representative of the machine travel or operating cycle, and upon which the significant positions or phases are marked. For each contact a solid heavy line indicates the range over which it is closed.

Diagram: Usually not required, but any electrically nonindependent contacts must be covered in some way.

C1a Cell Switch, Maintained Contact			
Contact	Position		
	In	Test	Drawout
1	X		
2		X	
3	X		
4		X	X
5		X	X

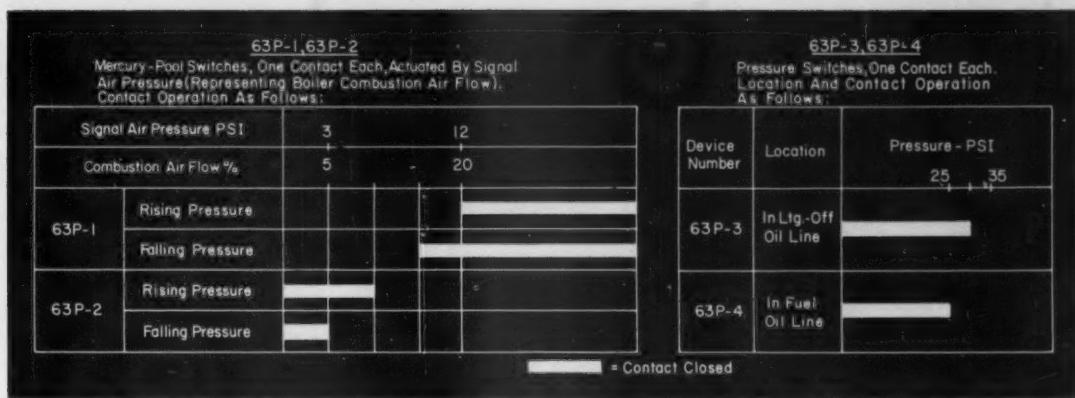


Fig. 9. Switches Actuated by Sensing Devices— switches responsive to system conditions, such as temperature, fluid pressure, flow, level, and the like. The treatment of these devices should receive great care, as a thorough understanding of their role in the process is essential.

Identification: Usually indicates the functional application, such as pressure switch.

Application: This should be very clearly spelled out, including the nature of the condition sensed, of just what part or fluid, and just where in the cycle. Sometimes the specific point of attachment may be necessary.

Operation: Usually consists of a simple actuation of the switch. State operating point in terms of the significant system parameter. If setting is adjustable, so state and give range of adjustment. Sometimes there is a differential in the point of operation with respect to increasing or decreasing intensity of the parameter. If so, signify appropriately. If the word description becomes unclear or unduly lengthy, use a development.

Face Appearance: Not required.

Contacts: The number and their position with respect

to the point of actuation must be given, including the differential, if any. Designation by normally-open or normally-closed might seem useful, but the tendency to work in a normal condition of the system is too prevalent, the implications of Section 2-9.7.2 of C37.2 notwithstanding. Any electrical nonindependence of contacts should be noted. In the interest of sensitivity, these devices are frequently produced by manufacturers with electrically nonindependent contacts, sometimes without clear designation in their literature.

Development: If a development is necessary, the bar chart is very effective here. It should cover the operating range of the system, and might very well be open-ended at either or both extremes. The significant values of the controlling parameter should be indicated, with the position of each contact shown in relation thereto, the heavy solid line meaning closed. If there is differential action, two lines for each contact should be shown, one for increasing intensity and one for decreasing intensity.

Diagram: Generally not required, unless any electrically nonindependent contacts are best covered thereby.

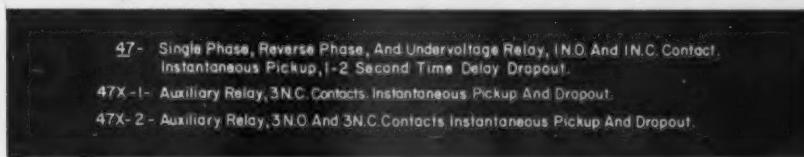


Fig. 10. Relays— devices of many types and uses. Even simple relays require substantial treatment for complete coverage. Usually word descriptions will suffice, but sometimes the complications become such that it is advisable to make use of additional means of elucidation, such as the development and the diagram.

Identification: Identify by use or function.

Application: Comprises an elaboration, if required, of the identification.

Operation: Describe electrical and mechanical actuation, including any time delay.

While it is common practice not to mention instantaneous action when no time delay exists, this can lead

to an oversight. It is better to designate such relays as instantaneous pickup and dropout. When time delay is present, the direction in which this time delay prevails should be stated.

Face Appearance: Not required.

Contacts: Give number and define their positions with respect to the electrical and mechanical actuation of the relay. Electrical nonindependence of any contacts should be noted. In the simple relays, the concept of normally-open and normally-closed should be free of any ambiguity, and may be used.

Development: Not often required.

Diagram: Used by many to save words in description.

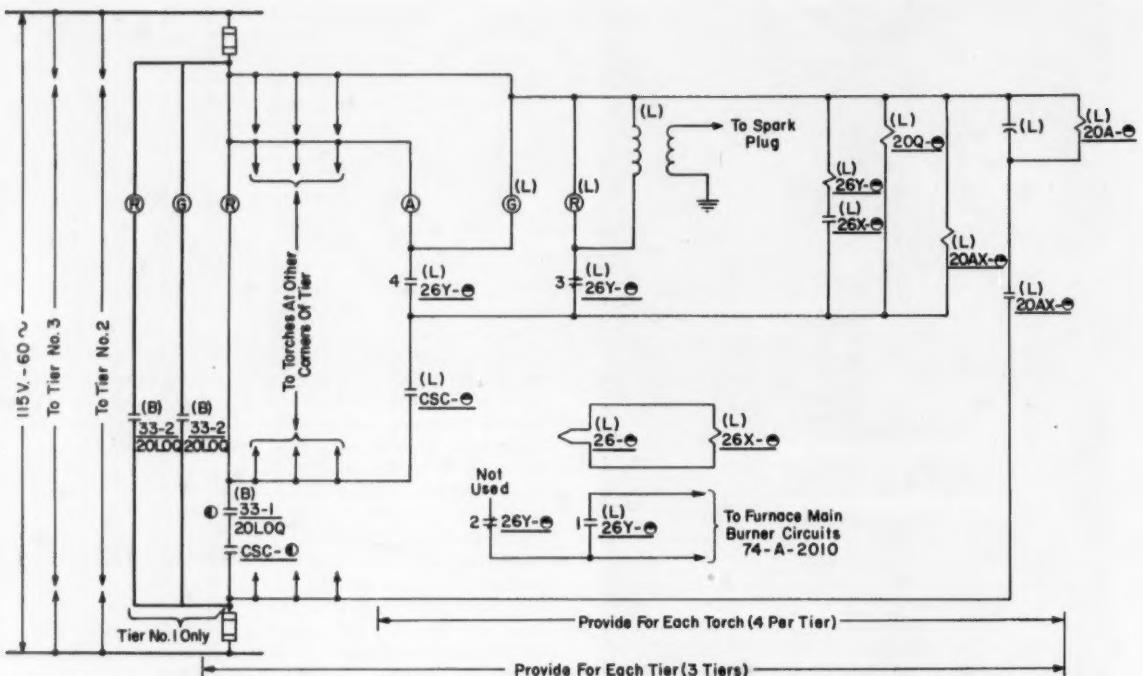


Fig. 11 – Single diagram indicates wiring for furnace pilot torches located in three tiers of four each.

normal running" used in Item (d) of Note 4 is a case in point. The relay is permissive in the normal position, nothing of necessity being running. It is believed the wording brings this out. Then, the word "running" was preferred over "operation" as being somewhat less general and more definitive. Finally the word "set" was used although the word "reset" properly occurs where used in the definition of the 86 device in C37.2. To use "reset" in Note 4(d) would have implied an unnecessary, even if related, circumstance.

Mention of another item, involving the latch-checking switch LC on a breaker operating mechanism, adds an interesting sidelight to this matter of careful scrutiny and selection of words. Standard C37.2 describes the LC operation as: "closed when circuit-breaker-mechanism linkage is re-latched after an opening operation of the breaker." It is easy to criticize something after it has been published, but it seems that introducing the history of the breaker is irrelevant. Surely any breaker must have operated at least once in its lifetime, even if only on test at the manufacturer's works.

Other portions of the description seemed artificial and undefinitive. To clarify the situation, this feature was studied on a number of makes and kinds of circuit breakers. The result was the following description for LC, which at least at the present seems to describe satisfactorily all cases reviewed:

"closed when trip-free linkage of operating mechanism is in position to permit closure of breaker."

Plant Geography

Now we can return to Note 2, which applies to the indication of location of various devices. Plant geography involves more than clarifying and amplifying. While such information unquestionably will be helpful to some users, such as maintenance men, it was introduced primarily to make the elementary diagram of greater use as a tool in the preparation of other drawings.

The distinguishing characteristic of the elementary diagram is that each portion or branch of a circuit is pulled out into a straight line. Each branch can be developed as a more or less independent component between certain common connections or buses. Usually these branches are developed as the circuit analyst gets to them, with the result that closely related branches, which are often parts of a more inclusive wire group, may occur at widely separated locations on the sheet. Subsequent wiring analysis is necessary for determining wire groups and minimum wiring.

When a plurality of branches, related by reason of being parts of a more inclusive wire group, are further related by having a degree of common plant geography, it is possible to combine some of the later analysis work with the initial analysis work

© Table 'A'				
Torch Location	Item	Tier No.1 EI. 43'-11"	Tier No.2 EI. 46'-6"	Tier No.3 EI. 50'-4"
Corner A (N.E.)	20A - 0	20A - 1A	20A - 2A	20A - 3A
	20AX - 0	20AX - 1A	20AX - 2A	20AX - 3A
	20Q - 0	20Q - 1A	20Q - 2A	20Q - 3A
	26 - 0	26 - 1A	26 - 2A	26 - 3A
	26X - 0	26X - 1A	26X - 2A	26X - 3A
	26Y - 0	26Y - 1A	26Y - 2A	26Y - 3A
Corner B (N.W.)	CSC - 0	CSC - 1A	CSC - 2A	CSC - 3A
	20A - 0	20A - 1B	20A - 2B	20A - 3B
	20AX - 0	20AX - 1B	20AX - 2B	20AX - 3B
	20Q - 0	20Q - 1B	20Q - 2B	20Q - 3B
	26 - 0	26 - 1B	26 - 2B	26 - 3B
	26X - 0	26X - 1B	26X - 2B	26X - 3B
Corner C (S.W.)	26Y - 0	26Y - 1B	26Y - 2B	26Y - 3B
	CSC - 0	CSC - 1B	CSC - 2B	CSC - 3B
	20A - 0	20A - 1C	20A - 2C	20A - 3C
	20AX - 0	20AX - 1C	20AX - 2C	20AX - 3C
	20Q - 0	20Q - 1C	20Q - 2C	20Q - 3C
	26 - 0	26 - 1C	26 - 2C	26 - 3C
Corner D (S.E.)	26X - 0	26X - 1C	26X - 2C	26X - 3C
	26Y - 0	26Y - 1C	26Y - 2C	26Y - 3C
	CSC - 0	CSC - 1C	CSC - 2C	CSC - 3C
	20A - 0	20A - 1D	20A - 2D	20A - 3D
	20AX - 0	20AX - 1D	20AX - 2D	20AX - 3D
	20Q - 0	20Q - 1D	20Q - 2D	20Q - 3D
Corner D (S.E.)	26 - 0	26 - 1D	26 - 2D	26 - 3D
	26X - 0	26X - 1D	26X - 2D	26X - 3D
	26Y - 0	26Y - 1D	26Y - 2D	26Y - 3D
	CSC - 0	CSC - 1D	CSC - 2D	CSC - 3D

Device Identification

X	Auxiliary Relay, 2 N.O. Contacts, Instantaneous Pickup And Dropout.
Y	Auxiliary Relay, 4 N.O. Contacts, Instantaneous Pickup And Dropout.
<u>20A</u>	Solenoid Valve In Air Line To Individual Torch.
<u>20Q</u>	Solenoid Valve In Oil Line To Individual Torch.
<u>20AX</u>	Auxiliary Relay, 1 N.O. Contact, Instantaneous Pickup And Dropout.
<u>26</u>	Thermocouple In Pilot Torch.
<u>26X</u>	Sensitive Thermocouple Relay, 1 N.O. Contact Instantaneous Pickup And Dropout.
<u>26Y</u>	Heavy Duty Thermocouple Relay, 2 N.O. And 2 N.C. Contacts, Instantaneous Pickup And Dropout.
<u>20P</u> <u>IDFID</u>	Pilot Valve. When Solenoid Is De-Energized, Induced Draft Fan Inlet Damper Operator Receives Air From Control System For Damper Position Control. When Solenoid Is Energized, Damper Operator Receives Full Air Pressure, Closing Damper.
<u>20P</u> <u>FCAR</u>	Pilot Valve. When Solenoid Is De-Energized, Control Air At Full Pressure Is Admitted To The Control System Of The Fuel Cutback Air Relay. When Solenoid Is Energized, Control Air At Reduced Pressure Is Admitted To The Control System Of The Fuel Cutback Air Relay, Causing Fuel Cutback.
<u>20P</u> <u>APAOD</u>	Pilot Valve. When Solenoid Is De-Energized, Air Pre-Heater Air Outlet Damper Operator Receives Air From Control System For Damper Position Control. When Solenoid Is Energized, Damper Operator Is Ventied, Closing Damper.
<u>20P</u> <u>APBRD</u>	Pilot Valve. When Solenoid Is De-Energized, Air Pre-Heater By-Pass Recirculating Damper Operator Receives Air From Control System For Damper Position Control. When Solenoid Is Energized, Damper Operator Is Ventied, Closing Damper.
<u>20P</u> <u>APGID</u>	Pilot Valve. When Solenoid Is De-Energized, Control Air Is Admitted To Air Pre-Heater Gas Inlet Damper Operator, To Open Damper. When Solenoid Is Energized, Control Air Is Admitted To Operator, Closing Damper.
<u>33-1</u> <u>APGID</u>	Position Switch On Air Pre-Heater Gas Inlet Damper. IN.O. Contact, Closed When Damper Is Fully Closed.
<u>33-2</u> <u>APGID</u>	Position Switch On Air Pre-Heater Gas Inlet Damper. IN.O. Contact, Closed When Damper Is Fully Open.
<u>33-1</u> <u>20LOQ</u>	Position Switch On Lighting-Off Oil Valve, 4 Contacts, Closed When Valve Is Open.
<u>33-2</u> <u>20LOQ</u>	Position Switch On Lighting-Off Oil Valve, 2 Contacts. Contact 1 Closed When 20 LOQ Valve Is Closed, Contact 2 Closed When Valve Is Open.

Fig. 11 — Keying part nomenclature to the corner and tier identification in table clarifies the diagram.

and make the diagram up in a way that will enhance its usefulness. If these doubly related branches are drawn alongside one another in the diagram, the true nature of the joint wiring extending between separate geographical locations can be brought out. This facilitates the determination of the cable and conduit scheduling.

It also is a powerful tool in analyzing the circuitry for minimum wiring. Minimum wiring is not always the numerical minimum possible. Sometimes, when a wiring group extends to several locations at different distances from some focal point, and it is possible to make up the circuit in a variety of ways, it may pay to run more wires between the nearby locations and fewer between the widely separated locations even though the over-all result is not the absolute numerical minimum for the combination being considered.

This treatment is most advantageous when restricted to major plant geography. It could be carried to any degree of refinement, but generally the localized geographical differences are handled readily by the usual methods. If carried too far, the diagram would cease to be an elementary diagram and would become the wiring analysis study.

Utilizing Geography

This approach was first made to aid in the development of the cable and conduit schedules. On a job

of any size these schedules represent such a considerable amount of work that it was felt that anything which would reduce the effort involved would be a valuable labor saving device. When a diagram is made in this manner, the cable and conduit man can take a print of the drawing and draw irregular rings enclosing groups of symbols, such as for contacts and coils, representing parts of devices that are in the same location, remote from the focal point, or origin, of the wiring, and making up part of a common wiring group. The goal is to arrange the wiring on the diagram so that when an irregular ring is drawn, it cuts once (and only once) each line representing a wire between the origin and the particular remote group that is under consideration. When this is done, the count of the line crossings which the irregular ring makes is the count of the number of wires required for that group between the two locations.

In a diagram of considerable magnitude, there ordinarily will be a number of irregular rings to be drawn, depending upon the number of different remote locations, with some of the locations requiring, themselves, a number of rings. By color-coding the rings according to geographical significance, the wire routings are made to stand out. The total count of crossings of a given color is the count of all wires over that route. These may be combined to best advantage according to other design criteria

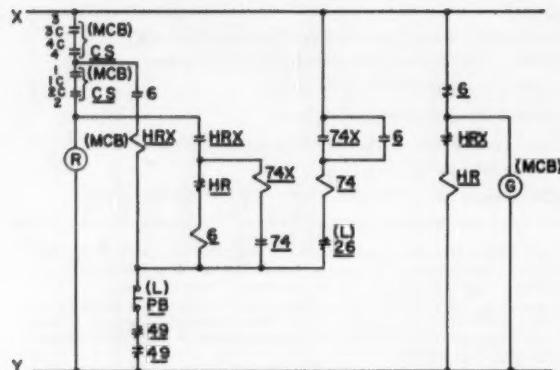


Fig. 12—Diagram made without considering geography.

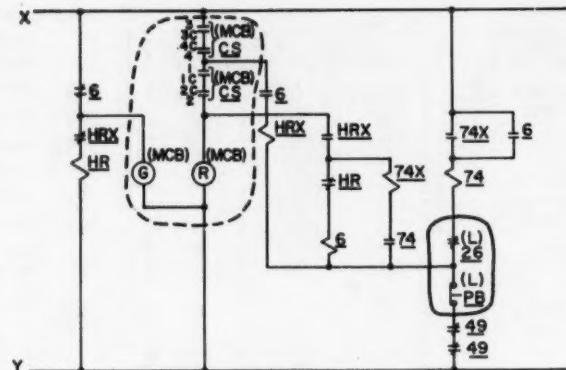


Fig. 13—Diagram with parts in same location grouped.

for the job — such as multiconductor cable groupings or conduit size limitations.

To illustrate, Figs. 12 and 13 show the same elementary diagram, Fig. 12 made without considering geography. The device parts remote from the motor control equipment have been given location marks, (MCB) for those on the main control board, and (L) for those local to the machine for which the control diagram was drawn. In Fig. 13 portions of the diagram were rearranged so that device parts having the same location marks are close together. Now, when irregular rings are drawn around these parts, a count of the wiring is obtained.

Other advantages were quickly found from this treatment. Analysis for minimum wiring has been mentioned. The location marks aid considerably in this regard. Detection of possible sneak circuits is facilitated. The possibility of getting the return wire into a different conduit is reduced. Possible consolidation of geography becomes more apparent, such as routing to a more distant point by way of a nearby group location. By and large, the concept and understanding of the circuit are enhanced, and subsequent revisions are facilitated.

Economy of Geographical Treatment

This treatment does not represent extra work. Actually it is some of the hidden work that always is done but lost to the job because it is on little pieces of paper in the designer's drawer. The elementary diagram has been the blunt instrument by which the wiring needs of the job have been attacked. Always there must be precision handling to produce a properly refined result. All too often this precision work is done several times because it is treated as back-up work. It certainly must be done, at least partially, by the several different people who are interested in some of the design details but do not have access to the back-up data. Incorporating some of this back-up work in the fin-

ished product can reduce duplication of effort, aid in uniformity of result, and greatly facilitate some of the other processes of design.

Additional Developments

This multipronged program of rationalizing the format and increasing the utility of elementary diagrams is still under development and has numerous ramifications. Some of these would be unique to our firm's individual methods while others may have some general interest. Aid in purchasing has been mentioned. On a project of any size, there are many control devices that the engineer must keep track of and procure. Some of these would be procured as individual devices while some may be included as parts of machine assemblies, and local or central control boards.

Push-button stations and control switches are good illustrations of this class of item. Their generic identification would be PB and CS. However, many exactly alike will be used throughout the job. Each kind can be given an identifying subscript according to its electrical and physical individuality, such as PB_a, PB_b, CS_a, CS_b, sufficient to distinguish it from any other item of similar type but different detail on the job. Then each designation will mean exactly the same description regardless of where it occurs, thus aiding material control.

The degree of completeness to which items need be described varies with circumstances. Before the particular make is known, the parts and features required by the diagram and functional operation of the circuit establish the minimum. The device as eventually provided may have additional parts, such as extra contacts on a relay. Including information as to unused contacts and similar features in the final description can be useful in the event of subsequent changes.

Setting up the diagrams so that the location analysis can be used with its greatest benefit some-

times requires a bit of ingenuity. Double-break valve control circuits are some of the trickiest. These have to be practically turned inside out with respect to the usual manufacturer's drawing. But when so everted it is felt that they are much clearer. The open and close circuits show up as two coordinate parts, while interlocks, such as closing preference, show up well, and the double-break feature stands out.

Other tricky combinations are machines, such as pumps, that are paired, one to take the lead, and the other to back it up, with the lead and back-up unit either selectable or automatically alternated. Here certain parts of the controls may transfer from one unit to the other, while the transferring device is common to both but has similarly assigned components in duplicate. It is possible to make a single diagram in which the complete wiring for both lead and back-up service for one machine is shown. Properly drawn, with the parts properly labeled, the one diagram can be read for either machine, the other one being imagined as the mirror image of the one shown (Fig. 14). The designers do not take kindly to this one, but it has been found to put them on their mettle and to aid in the avoidance of errors. As a trial balloon in the early stages of this development, one of these was sent to a manufacturer with no more explanation than given on the regular drawing. His factory prints came back in full mirror image form — absolutely correct.

An amusing incident occurred when some very preliminary elementaries had been received from a major manufacturer. In reply we sent a set of our elementaries, and in return received a new set of the manufacturer's elementaries, revised according

to the full panoply of our format as shown by our submittal. Naturally we were pleased, and approved them promptly, but had no illusions about reforming the world. Sure enough, the final issue came through in due course, all redrawn according to that manufacturer's method and format. No doubt some pioneering project engineer was taken to task by his supervisor for breaking with tradition.

Conclusion

We see, then, that there are four important features in the making of elementary diagrams:

1. Details of format and nomenclature in the interest of clarity and uniformity.
2. Informational requirements necessary to an understanding of the diagram.
3. Methods of description and presentation to enhance exactitude and minimize misinterpretation.
4. Introduction of plant geography at an early stage in the diagram development.

Points 2 and 3 perhaps are of greater concern to more people than are points 1 and 4. Certainly everyone who uses a diagram, even if only in part, will want to have all the necessary information and have it straight. It must not be overlooked, however, that some of the people who use elementary diagrams are members of the originating organization, and full and clear comprehension at that point pays substantial dividends.

Points 1 and 4 are of the nature of improved methods. These are of prime importance to the originating organization, but probably will have a beneficial effect under any circumstances, particularly insofar as they enhance clarity and contribute to understanding. ▲▲

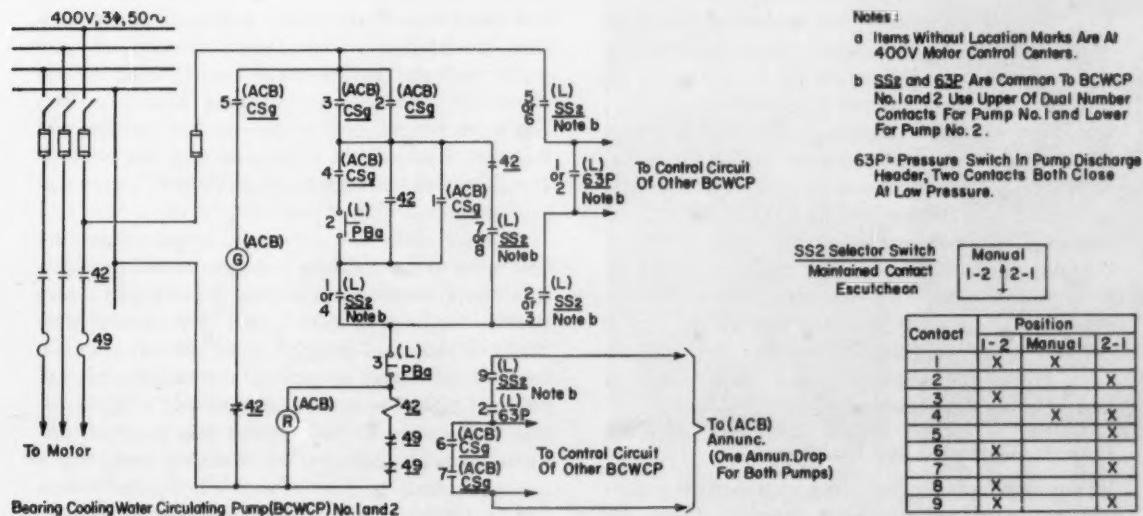
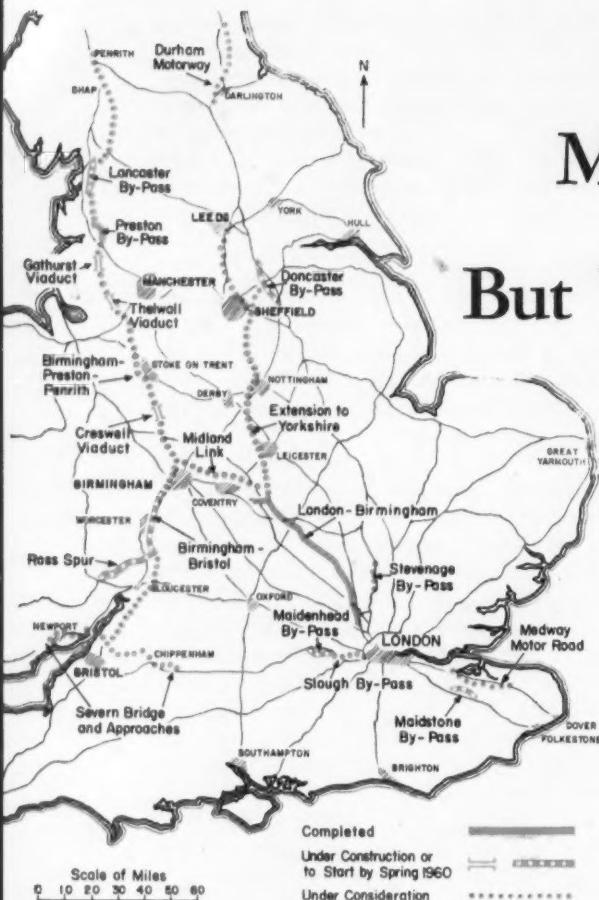


Fig. 14 — Single diagram, properly drawn and with parts properly labeled, can be read for two machines.



More Motorways...

But Who Designs Them?

Britain is working furiously on a new network of motorways, dual carriageways, flyovers, and roundabouts. The consulting engineer is hanging onto, even increasing, his share of the design work.

By THE ECONOMIST
INTELLIGENCE UNIT LTD.

AFTER YEARS of virtual stagnation in the building of even ordinary roads, Britain suddenly has embarked upon an ambitious program of constructing superhighways. To U.S. engineers even the present program may not represent breakneck speed, but, compared with what happened before, it seems as if superhighways — or motorways as they are called in Britain — have become a government obsession.

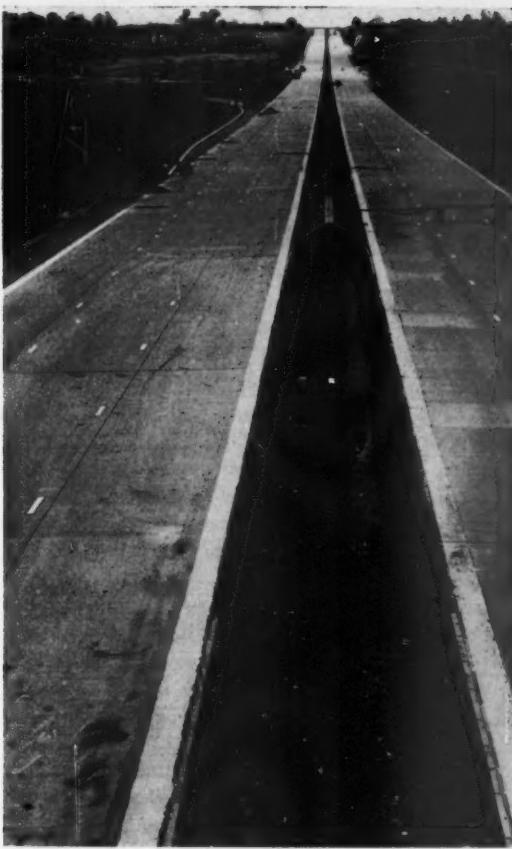
Starting late, Britain has had the advantage of learning from the experience of other countries. Certainly there has been plenty of time in which to study the best methods of organizing and carrying out these projects. Even so this has not meant — could not mean — that Britain has been able to avoid all the difficulties; these have, however, been kept sensibly in proportion.

Projects Completed and Underway

By any standards the first major section of the motorway to be opened was built speedily. About 60-miles long with three traffic lanes in each direction,

it links London with the Midlands and will later be extended northwards to Yorkshire where it will join the Great North Road. A branch to Birmingham, the Midland's largest town, already has been built, and this in turn will be extended to the northwest, serving Liverpool and Manchester on the way. A new road, to be planned shortly, will link this northwestern motorway with the Scottish border and the existing trunk roads to Glasgow and Edinburgh.

Another motorway soon will be laid from the Midlands to the southwest. A spur to South Wales is already under construction. Present plans also provide for London to be linked by motorway with South Wales, and lengths of motorway are now under construction to improve communications between London and the Channel ports of Dover and Folkestone. To supplement this program, improvements to existing trunk roads are being made or are planned, the most extensive being the widening at various places of the Great North Road, which then will have dual carriageways (two lanes



Motorway exit distances are sited at locations of 500, 200, and 100 yards ahead of deceleration lane.

in each direction) for the greater part of its length. It still will not be a motorway, for access will not be limited. This fact alone is a good indication of how far behind the other major industrial powers Britain has slipped in constructing fast highways without intersections or roundabouts (traffic circles). Even those who, before the Second World War, saw fit to praise Hitler for the autobahns that his regime built did not carry their admiration to the extent of pressing the British government to follow the German example.

Great Britain has the most comprehensive network of roads of any country in the world, but neither the roads nor the bridges were designed to meet the fast increasing volume of traffic, particularly the heavy commercial loads. These roads have grown over the centuries, and most of them are narrow and winding, except in a few locations where the lines still follow the original straight Roman roads.

The surface of the great majority of these roads is well maintained, but their foundations are mostly

unknown as they have grown from farm tracks and have gradually been widened and improved in a piecemeal fashion. Many of them are not suited to being brought up to the standard demanded by present day traffic, and many of the bridges are narrow and below strength. To travel from one industrial area to another usually involves going through the center of each town or village on the way. Some bypasses have been built in the past to relieve the congestion in towns and villages but these are for the most part only single carriageways, three lanes wide, and do little more than relieve traffic in the local town.

Motorways Bring Problems

Maintenance and improvement of this growing network of roads is carried out by the urban and borough councils or by the county councils, according to the class of road. The work is organized locally and not at a national level; hence there is considerable variation in the road standards. For trunk roads, maintenance and improvement normally are undertaken by the county councils on behalf of the Ministry of Transport (the central government authority), and often this work is done with very little modern equipment.

However, with motorways extending from one major industrial center to another, the project is no longer local. A new motorway may extend through many counties, and if the work is handed over in sections to the counties through which it passes, obvious difficulties arise in coordination and design, particularly as the ultimate construction of



Signs use white on blue background and make ample use of symbols. Emergency phones are located at approximately one mile intervals. They connect directly with police stations; are for emergency only.

a length of road through several counties may be let as one contract.

What is more, many county authorities do not have sufficient staff to survey and design projects of this magnitude in addition to their normal road improvement schemes and maintenance work. And since experienced, qualified engineers are not plentiful in Great Britain, it is difficult for the counties to recruit suitable additional personnel. It is also uneconomical, as this increase in staff probably will be needed only for a comparatively short period, and government employees are notoriously hard to discharge when the load lightens.

Consultants Ease Motorway Design Burden

The disadvantages of handing these superhighways over to local authorities are common enough, and they account for the growing practice of the Ministry of Transport of appointing private firms of consulting engineers to design and supervise construction of motorways for them. In this respect Britain is following the practice adopted on a large number of turnpikes and toll roads in the United States. But it cannot be said that this is general practice internationally. In European countries, most of the highway design work is carried out by the highway authorities. However, there seldom is any settled practice even within one country; most authorities vary their procedure.

In Britain consulting engineers have a much wider experience in road building than any local authority can have, not only because they have worked in different parts of the country under varying conditions, but also because many have worked abroad, especially in Commonwealth countries. Many low cost roads have been successfully designed by British consulting engineers in Africa and the Far East, and a great deal of valuable experience has been gained, particularly in the practical application of soil mechanics.

Furthermore many British engineers have not let their country's lethargy in building motorways prevent them from keeping abreast of current developments abroad. They have sent members of their staff to the United States to study highway engineering and soil mechanics.

Britain's Urban Road Problems Unique

Some firms now are establishing traffic engineering departments to assist in the design of urban motorways and throughways. With a large population crowded into a small area, towns are much closer to each other than the towns in the broader plains of America, or even Continental Europe. And as most of the main roads go through town centers, it is clear that urban congestion is much more serious than traffic problems between towns. Even

now it takes as long to get from the center of London to the beginning of the motorway to the Midlands as it does to do the rest of the journey to Birmingham, which is over 100 miles from London.

The other complexities of taking large roads through dense towns — the difficulties of land acquisition, property demolition, and the fact that the exact location of existing water mains and electric and telephone service lines is often unknown — make the experienced staff of the consulting engineer firm necessary for the design and supervision of construction of urban motorways. The borough councils have not enough staff for these large new works, and there is no doubt that private firms will have a very large part in the future design and construction of roads of this type.

Many contractors in Britain prefer being supervised by independent firms of consulting engineers, as they act impartially in disagreements between the contractors and the clients, and both parties usually accept the consulting engineers' decisions. Engineers employed by local and county councils are to a greater or less degree influenced by their governing committees, who are in effect the client.

With the motorway program to date the Ministry of Transport has been using both consulting engineers and the county Council's Highway Departments as their agents for design and supervision. In many instances, however, the county councils themselves have called in consulting engineers to design the bridges on their sections. There are, on an average, about 2½ bridges per mile.

Package Bidding Not Generally Accepted

There has been considerable commentary in the press recently regarding "all in bids" or "package bids." In Britain this means the method under which



Maximum gradient on British motorway is limited to 1 in 30. Roadway is 36-ft wide in each direction.

invitations to bid are based on a statement of objectives the project is intended to achieve and requirements that will have to be met to achieve them (loading, widths, clearances, . . .). Each contractor then must submit his own design and his price for carrying it out.

This method has not been adopted generally in this country, although it is fairly common on the Continent. It is commonly used in Germany, for example, although by no means exclusively. Its disadvantages are legion. It is wasteful of experienced design staff because of the number of bidders who would all be designing the same work but only one of whose designs would be used. It takes more time, and the lowest bidder might submit designs for his bridges which, though functionally adequate, might have an unpleasing appearance and might not satisfy the Royal Fine Arts Commission in Britain. (All designs for bridges have to be approved by the Royal Fine Arts Commission, which is an advisory body set up by Government.) This method of tendering also has the serious disadvantage that the amount of land to be acquired will vary if the line and level of the motorway is not rigidly fixed, and this would entail further delays if more land had to be purchased and Public Inquiries held when objections were lodged by the owners.

British consulting engineers prefer to rely on the well tried system of inviting competitive bids from experienced contractors based on a set of general conditions of contract, specifications, contract drawings, and bills of materials prepared by the consulting engineers. It is, however, generally agreed that a contractor should be given the opportunity of making amendments to the design of bridges to facilitate his particular method of construction, and that he should be encouraged to do this provided he prices the original design as well as the amended one.

Standardized Design?

It has at times been suggested that design of bridges should be put out to competition before bids are invited, but this sets up the possibility of all sorts of ethical difficulties unless the competition were handled in a most careful manner and under supervision of professional organizations. For large bridges there are very few firms in Great Britain who are in a position to enter a competition, but for medium size bridges competitions in design might be appropriate.

It also has been suggested that flyovers (overpasses or underpasses) for motorways should be of standard design, but in actual practice the spans, skews, and foundations of these structures vary so that the time taken to fit in a standard design



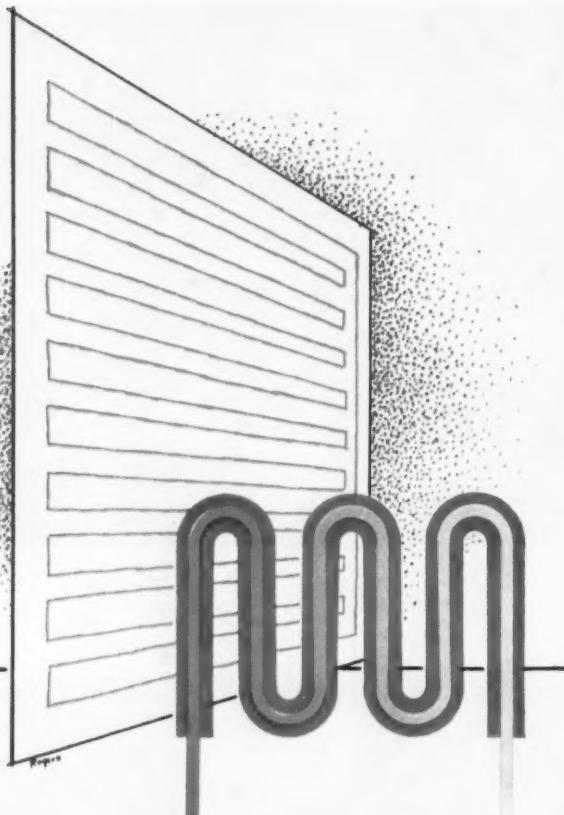
Spotter aircraft will patrol London to Birmingham motorway to provide continuous breakdown service.



Aerial view shows details of typical flyover with exits and entrances to both lanes of the motorway.

to a particular site would be no less than designing anew. It has to be borne in mind that the topography and scenery in Great Britain changes so rapidly that standard bridges often would not harmonize with their setting.

There is no doubt that the best way of achieving rapid and economical construction is to arrange for the specifications and drawings to be completely detailed and settled before any work commences. Then the contractor knows exactly what he has to do, and his program is not upset by alterations and amendments which not only delay him but increase the cost of the work to the client. ▲▲



When to Specify Electric Heating

ROBERT L. WHITTLESEY

Robert L. Whittlesey and Associates

ELECTRIC HEATING is not new. It has been in use since the discovery of electricity. However, in recent years traditional resistance methods have been improved and new methods have been developed, particularly the heat pump and solar collection systems. This technical progress has made the application of residential electric heating increasingly popular.

Meanwhile, rate structures of many utility companies have improved enough to make the use of electric heating economical. The cost of the fossil fuels — coal, gas, and oil — has been increasing, while electric rates have been decreasing. These factors have caused a rapid increase in the amount of electric heat being used today. This increase can be expected to continue at a more rapid rate as new developments make the application of electric heating even more economical and desirable.

Study is Warranted

At this time comparatively little is being done to make thorough studies of the heating requirements for industrial plants, department stores, or office buildings to determine whether or not electric heat

actually would be economical. More objective analyses can, and will, be made as building owners and consultants become more conscious of the advantages available from electric heat — convenience, cleanliness, and lower installation and operating costs.

Any analysis of electric heating should be based on the following information:

- ¶ Electric heating systems available, including resistance and nonresistance types.
- ¶ Construction requirements for electric heating.
- ¶ A complete heat balance study as a basis for determining first costs and operating costs.

Types of Electric Heating Available

Resistance heating is available in the following forms: radiant panels for installation in floors, ceilings, or walls; convection heaters installed in the wall with either gravity or forced fan circulation; unit ventilators; electric heaters for insertion in circulating air systems; electric boilers providing hot water or heated process fluid; and electric water heaters.

The early resistance heating systems used radiant panels in the ceilings, walls, and floors. They

have changed rapidly from the insert type of small size high temperature panel to the large area low temperature panel utilizing heater wires imbedded in the construction of floors, ceilings, and walls. Initial cost for such installations has been reduced to the point where it is one of the lowest for any type of heating system.

Convection heaters originally were manufactured as wall insert units for bathrooms and isolated rooms, but today they are available in a variety of styles. In fact, this type of heater will match in performance, appearance, and application any method of heating that has been used in the hot water or steam heating field.

Along with the development of terminal heating devices — baseboard heaters, radiant panel heaters, circulating heaters, and electric heaters for air duct installation — manufacturers have developed prime sources of heat for use in the conversion of existing heating systems from fossil fuel-fired to electric heating. For example, electric boilers are now available to provide either water or steam.

The heat pump is the best known application of nonresistance electric heating and undoubtedly offers the greatest promise in the future application of electric heat. It has a coefficient of performance of from three to five, depending upon the heat sink used as a source of additional heat. This can be roughly interpreted to mean that the operating costs of the heat pump with a coefficient of performance of three will use $\frac{1}{3}$ the electricity used by resistance heating for the same job. In addition, the demand surge for the heat pump installation is less than it is for a resistance heating installation. Utilization of heat storage devices levels off the electric demand at a lower, more constant rate.

A further advantage is that heat pump equipment can be used to both heat and cool — an important consideration with the trend toward year-round air conditioning.

Heat pumps use electricity to raise the heat level of a heat sink high enough so that it can be utilized for the space heating function. They usually use air, water, or earth as their source of auxiliary heat, and there are many opportunities to use waste heat from various sources.

When the heat pump is using air as its source, it can work from outside air or it can pick up exhaust heat from processes, from hoods, and from the exhaust systems of any space that has more heat than it needs to maintain its proper temperature level. Reclaiming and boosting of this heat can be accomplished economically by the heat pump.

Streams, lakes, ponds, and wells all may be good water sources of heat for the heat pump. Certain process wastes contain a great deal of heat, as does return water from heavily occupied or lighted and

overheated spaces. All of these sources can be utilized to bring heat to other spaces that need it.

Buried pipe systems circulating fluid or air are necessary for the heat pump utilizing earth as its heat source. The circulating of fluid or air through waste dumps from industrial applications where waste is hot or is warmer than air temperature can be an economical source of heat.

Recently the use of the solar collector with the heat pump has received attention. The sun is our greatest source of heat and so far has been utilized least. To be sure, the direct effect of the sun upon our buildings has a tremendous influence on the amount of fuel used during the heating season, but the indirect use of this energy from the sun is just now being developed. It is believed that the joint use of the solar collector and the heat pump will be one of the major developments in the application of heating with electricity.

Along with the development of the heat pump, great efforts are being made to develop efficient, compact, heat storage devices. These heat storage devices will level out the energy input demand and permit the full utilization of solar energy as well as energy from other sources in conjunction with the heat pump — all adding up to reduced electrical input requirements.

Construction Requirements for Electric Heating

Where electric heating and air conditioning are being considered, it is imperative that buildings be designed with specific regard to the window area and orientation to the sun, as well as wall and roof insulation. Recommended are: 6 to 9 inches of roof insulation ($U = 0.06$), 3 to 4 inches of wall insulation ($U = 0.08$), 2 inches of floor insulation over crawl spaces ($U = 0.11$), and excellent edge and perimeter insulation for slab-on-grade floors. Glass area should be no more than 20 to 35 percent of the wall surface, and in some colder areas double glass should be used. In the Denver area, a square foot of single glass loses 100 Btu/hr at -10°F outside temperature, and gains an average of 100 Btu/hr in the summer. Contrast these heat losses and gains with a square foot of well insulated wall, which will lose about 8 Btu/hr in winter and gain about 5 Btu/hr in summer.

Space requirements for electric heating are extremely small. Resistance heating with radiant panels requires no air ducts and practically no floor space, a major economy in new construction. With a nonresistance heating system, such as the heat pump, conduits and floor space are required but the location of the floor space is not as critical as in the fossil fuel heating systems. This is also true of the forced air systems which have resistance elements for heating the circulating air. None of

these systems require the usual flue or smokestack essential to fossil fuels.

Heat Balance Study

A complete heat balance study presumes a familiarity with the calculations of heat losses and heat gains and considers these calculations with special attention to internal heat gains. In the heating season these actually may contribute to the heating of the building. Lights, people, cooking, industrial processing, and similar heat sources, should be evaluated carefully. When the building cooling gain is about equal to or greater than the heat loss, electric heating should definitely be considered.

When to Use Electric Heating

Consider first the time-proven applications of electrical heating. Process heating has been done electrically for years. A more thorough heat balance study will provide even more opportunities for the application of electric heating and, more important, for the application of heat reclaiming.

Standby heating systems often lend themselves to the use of electric heat because of the compact size and low initial cost which can be achieved with electric heat components.

Electric booster heaters for raising fluid temperatures at the point of utilization have advantages, particularly when other electric loads in the building provide a competitive electrical rate.

Laboratory techniques requiring precision control are very adaptable to electric heat.

The greatest new field for electric heating undoubtedly is comfort heating in residential and human occupancy spaces. A thorough heat balance and economic study of some buildings now being designed might well indicate that electric heat has the advantage over conventional systems.

Specifically, when should electric heating be used? The best approach is to study the heat balance and the economics of electric heating for a particular building in a particular locality and to establish some standards for the application of electric heating. Considering the heating, ventilating, and air conditioning parameters, analyze a recently designed building in the area from the standpoint of the heat balance and the economics of installing a heat pump. Compare the resulting system with the conventional system which is currently being used in the building. There is a good chance that substantial initial cost savings could have been achieved and that the total cost of owning and operating the existing heating system over the life of the building will be very nearly as expensive, if not more so, than the electric system.

The present day office building is already electrically heated to some extent because of the high

intensity of its lighting. Taking into account this heating affect during the time when the lights are in use will result in a much lower net space heating requirement and will permit heating equipment to be tailored more closely to actual needs than is customary. Higher quality thermal insulation in ceilings and walls, and the use of thermal insulating glass, also will result in reduced heating loads. Thus, the net heating requirement often can be reduced and, when combined with the initial installation cost savings of electric heating, the total cost of heating over the life of the building may be reduced significantly.

Consider heat pump electric heat whenever the building is going to be air conditioned, because most of the equipment necessary to heat the building already has been purchased when the air conditioning equipment is purchased.

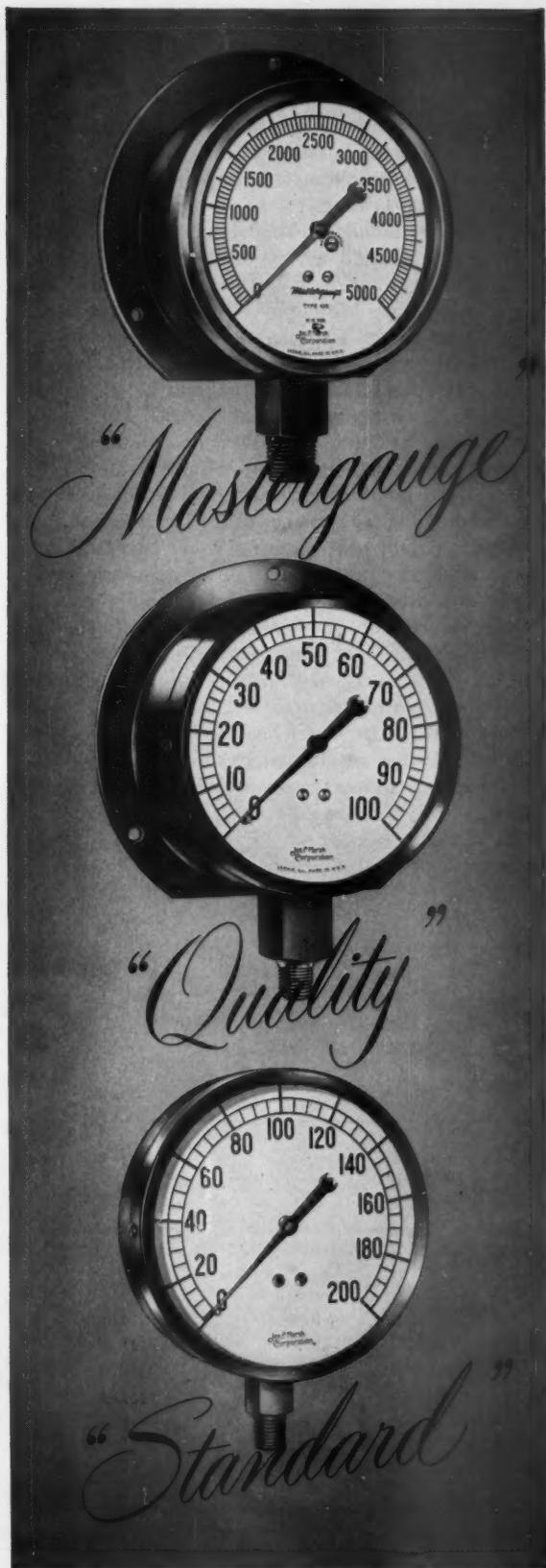
An important factor in evaluating electric heating is the rate structure established by the utility serving the area. Most utility companies today are providing very favorable rates when electric heating is used because it balances their annual consumption, particularly in areas where air conditioning loads are heavy. In many locations the air conditioning electrical load in the summer is much higher than the electrical load for lighting and appliances in the winter. It is to the utility company's advantage to have a relatively constant load on their electrical system the year around. Electric heating gives them a winter load to balance the high air conditioning summer load. Rural electric companies are especially interested in electric heating to balance the heavy electric load used for irrigating systems in the summer.

Many owners would enjoy the comfort, cleanliness, quietness, and convenience which electric heat offers. Many home owners, for example, have converted from coal to oil and later from oil to gas, not because it saved money, but because it was more convenient. It cost them more money each year, but the improvement in cleanliness and convenience was, to them, worth the price. Many owners also would like to use electric heat for these same reasons — even at higher operating costs.

Electric heating for supplementary heat in conventional heating, ventilating, and air conditioning designs also is worthy of consideration. An electric heat "coil" is a very economical answer to the problem of heating a small zone out on the end of a large trunk duct system.

When Not to Use Electric Heat

Electric heat should not be used where electric rates are prohibitive. However, this should be determined by a careful heat balance and rate study for the particular building in question. If a client



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still insists on electric heating after a cost study shows a fossil fuel system to be more economical, be certain that he understands what his increased operating costs will be.

Do not use electric heat for uninsulated structures with high heat loss per square foot, and little or no internal gain. Buildings with large glass areas, which were popular a few years ago, proved to have prohibitive operating costs because of their high heat losses and, particularly, their high heat gains during the air conditioning cycle. Electric heat should be applied only to buildings that are well planned from the standpoint of thermal insulation.

Electric heat should not be specified where electrical service is not dependable. An occasional power failure, however, is not of great importance, particularly where heat storage methods are used in conjunction with the heat pump to provide carry-over for a period of from 4 to 12 hours when the power may be off.

Office Building Study

An analysis of a 3500-sq ft, one-story, well insulated building, in Denver, Colorado, illustrates the comparative costs of gas and electric heat. This building presently uses a gas fired, hot water boiler and baseboard radiation for winter heating and air cooled, condensing, air conditioning units with overhead duct distribution for summer cooling. The heat loss from -10 F to +70 F is 130,000 Btu/hr, and the cooling gain for 15 F temperature differential is 112,730 Btu/hr.

As shown in Table 1, this installation was compared, both for natural gas and liquified petroleum gas firing, with alternates using electric resistance heating and electric heat pump heating. The arrangements considered were:

¶ System 1. The existing hot water heating system, using natural gas as fuel (accurate figures based on one year's actual monthly gas and electric bills).

¶ System 2. The existing hot water heating system, modified to burn liquified petroleum gas (important for sites where natural gas is not available).

¶ System 3. An alternate arrangement using an electric resistance heating system with radiation in the form of electric baseboard heaters.

¶ System 4. An alternate arrangement using electric heat pump heating.

In determining the annual energy costs for lighting, heating, and air conditioning with Systems 1 and 2, a gas boiler combustion efficiency of 80 percent and a gas heating over-all efficiency of 70 percent were used — probably giving gas a break in this analysis. Natural gas costs approximately 50¢ per 1000 cu ft (830,000 Btu), and liquified petroleum gas costs 15¢ per gallon (96,000 Btu).

Computations for Systems 3 and 4 are based on an electric heating over-all efficiency of 100 percent and an air to air heat pump seasonal over-all coefficient of performance of 2. (The frequent quick drops in daily temperature to below zero in Denver, as opposed to the lesser daily temperature ranges in other areas, puts the heat pump at a disadvantage in Denver, when the heating system is designed for -10 F outside temperature.) Electricity is available at an average cost of 2¢ per kw for continuous service, and ranges from 3.4¢ to 1.12¢ per kw. The 1.12¢ rate is for water heating and requires being "off" the line approximately three hours each day during the utility system peak load period. Therefore, both a 2¢ average rate (Systems 3a and 4a) and a 1.12¢ heating rate (Systems 3b and 4b) were used in the calculations.

Differentials in initial heating equipment costs were reduced to an annual basis, using 25 year amortization at 6 percent.

As shown in Table 1, System 4b — electric heat pump heating at 1.12¢ heating rate (with accumulator for carryover while power is off) — provides the most favorable annual cost. □

TABLE 1 — COMPARISON OF COSTS

System Number	Heating Method	Annual Energy Cost	Differential in Equipment Cost	Annual Fixed Charge On Cost Differential	Comparative Annual Cost
1	Natural Gas	\$1306.50	—	—	\$1306.50
2	Liquified Petroleum	1559.14	+\$ 500	+\$ 35	1594.14
3a	Electric at 2¢	2115.02	— 1800	— 126	1989.02
3b	Electric at 1.12¢	1604.29	— 1800	— 126	1478.29
4a	Heat pump at 2¢	1609.42	— 1200	— 84	1525.42
4b	Heat pump at 1.12¢*	1321.19	— 400	— 28	1293.19

*With accumulator for carryover while power is off.

...the most unusual curtain wall

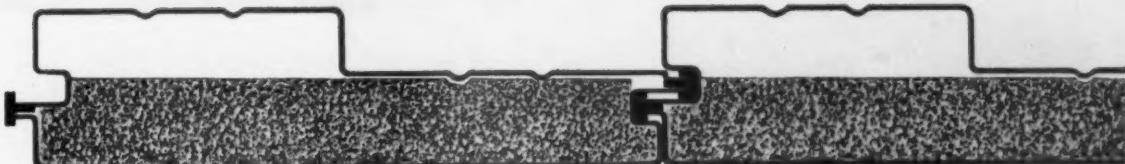
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Spanning ability is exceptional, as you can see from the configuration. Glass fiber insulation will not settle.

Beautiful Monopanl is furnished in a range of gauges. Exterior and interior faces can be specified in aluminum or galvanized steel. Choose from a selection of factory-applied colors. Integral fenestration is available.

For further information refer to Sweet's 1960 Architectural File. For complete technical details and actual samples of Monopanl, contact your Butler Builder. He's listed in the Yellow Pages under "Buildings" or "Steel Buildings." Or write direct for a descriptive brochure and data sheets.



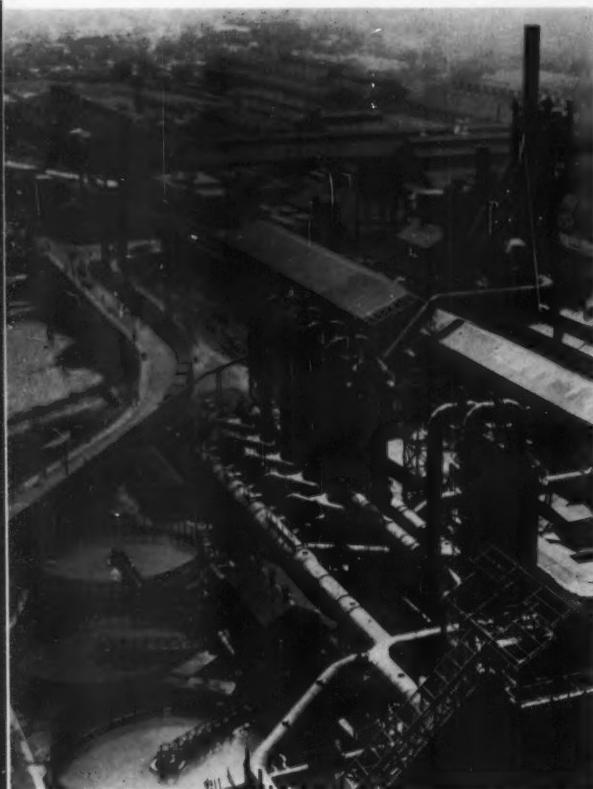
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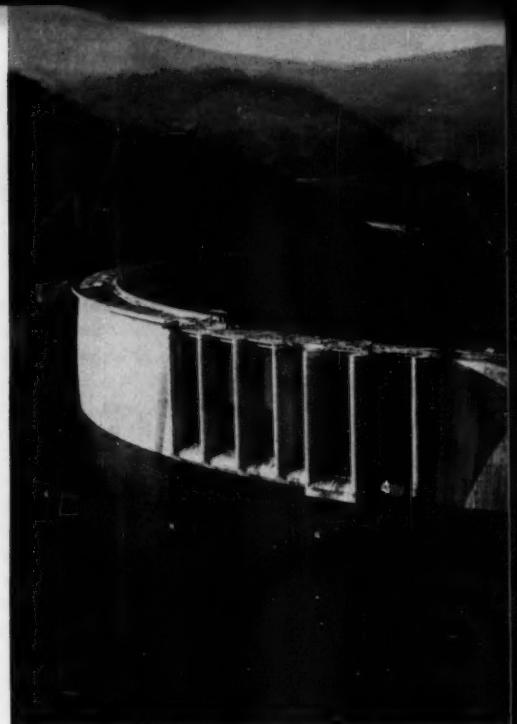
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Here are ten major engineering projects selected from 234 that have been fully or partly financed by loans from the World Bank (The International Bank for Reconstruction and Development). The engineering work on each of these projects was handled by a different firm of consulting engineers. While these selected projects were designed by either British or U.S. engineering firms, French, Italian, Danish, Brazilian, Iranian, Swedish, and Swiss firms also have been used on World Bank financed projects. Gail Hathaway, Engineering Consultant to the World Bank, points out that consulting engineers, approved by the Bank, have done the engineering on the projects financed by all of the last ten loans (\$200 million) made by the Bank. As of June 1959, a total of \$4522 million had been loaned by the World Bank.



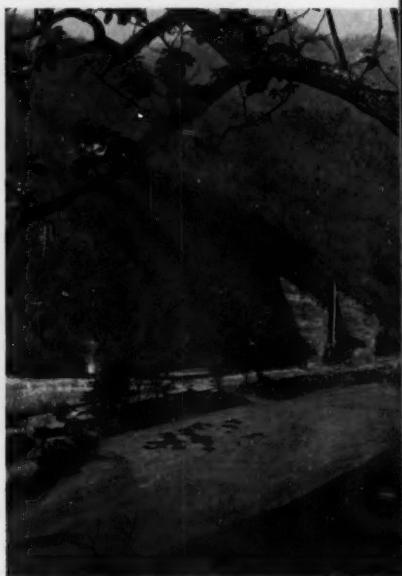
Although half of India's requirements for finished steel have been met from abroad, her production costs are among the lowest in the world. Two loans totaling \$107.5 million have been made by the World Bank to the *Tata Iron & Steel Company*, of Calcutta, India. This project was initiated in 1956 and its purpose is to match production to demand by early 1961. Kaiser Engineers, Division of Henry J. Kaiser Co., are the consulting engineers.



Ten Projects Financed

Designed by Consulting Engineers . . .

Site of the Pin River Dam, a major part of the *Yanhee Power Project*. Eventually this project will provide 560,000 kilowatts to 33 of Thailand's 71 provinces. The first stage will supply 140,000 kilowatts and was begun in July 1958 after a \$66 million loan from the World Bank. The engineering consultants are Sverdrup & Parcel (Int.), of St. Louis, Missouri.





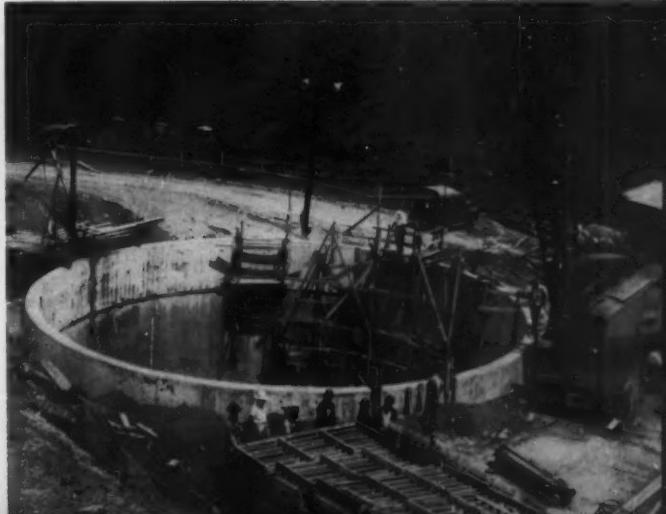
The loan of \$80 million toward the first stage of the *Kariba Hydroelectric Power System* in the Federation of Rhodesia and Nyasaland is the largest the World Bank has ever made for a single project. The total cost of this stage will be \$225 million and completion is scheduled for 1962. A 400-ft high arch dam across the Zambezi River will back up a reservoir 190-miles long and 40-miles wide. Present planned capacity is 500,000 kilowatts with ultimate capacity pegged at 1.2 million kilowatts. Nearly 1000 miles of transmission lines will carry power to the copper mines in Northern Rhodesia and the principal cities of Southern Rhodesia. Consultants for the project — a joint venture — are Sir Alexander Gibb & Partners, of London, England; Coyne & Bellier, of Paris, France; Societe Generale d'Exploitations Industrielles (SOGEI), Paris, France; and Merz & McClellan, Newcastle, England.

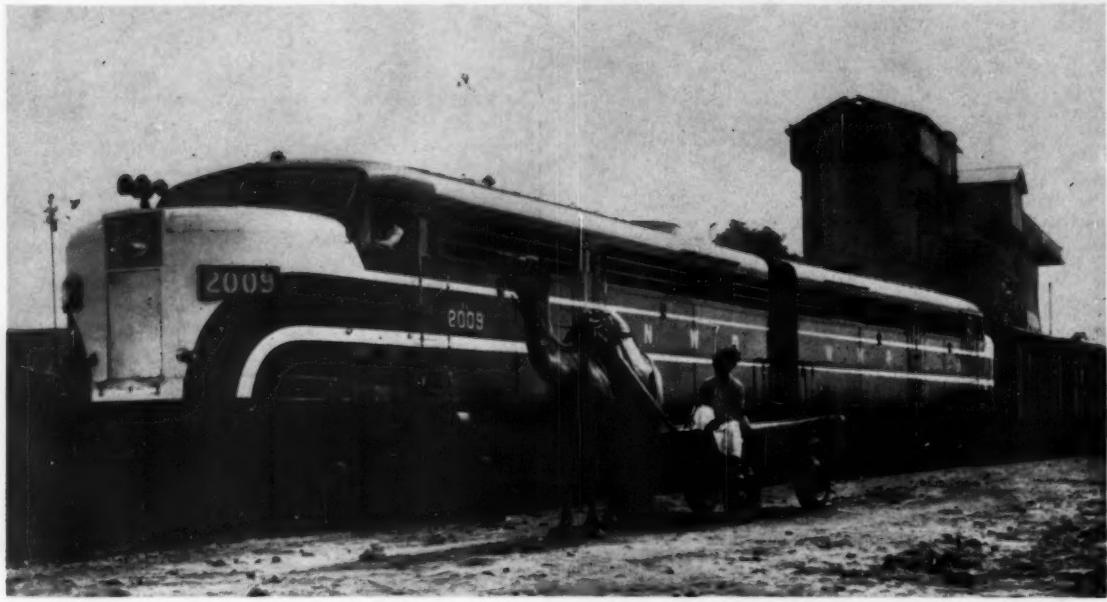
by the World Bank

A four-year road maintenance and construction program for the *Ecuador Highway System* is the reason for a \$14.5 million loan to Ecuador negotiated through the World Bank in 1957. The present system totals 2000 miles with four new roads to be constructed. Rader & Associates, of Miami, Fla., are the consultants.



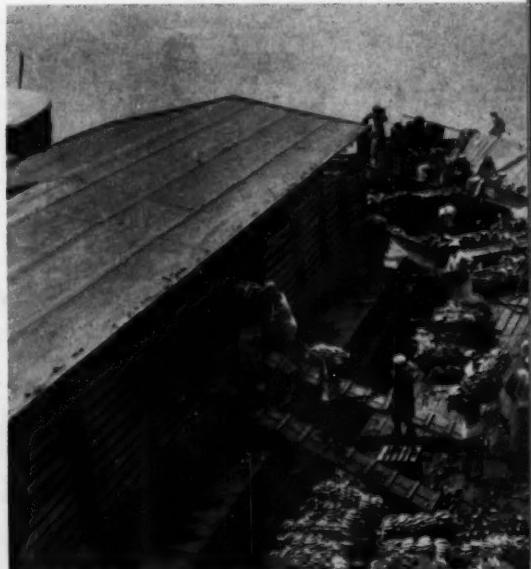
This reservoir near the Agno River in Luzon is part of the *Binga Hydroelectric Project* in the Philippines. In addition, a power dam, an underground power house with an installed capacity of 100,000 kilowatts, and transmission lines running 120 miles south are under construction. The World Bank loan is for \$21 million. Consultant for the project is Tippetts - Abbott - McCarthy - Stratton (TAMS), of New York.





Furnas Rapids is on the Rio Grande, 200 miles north of Sao Paulo, Brazil, where a 400-ft high earth and rock-fill dam will be built. The power station to follow will have an ultimate capacity of 1.1 million kilowatts. The first stage, now being financed, is rated at 460,000 kilowatts. The reservoir will be 150 miles long and provide sufficient storage capacity for year-to-year regulation of flow to the power station. The total cost of the *Brazil Hydroelectric Project* will be \$210 million, with \$72 million being supplied by the World Bank. International Engineering, San Francisco, California, is the consulting firm on this project.

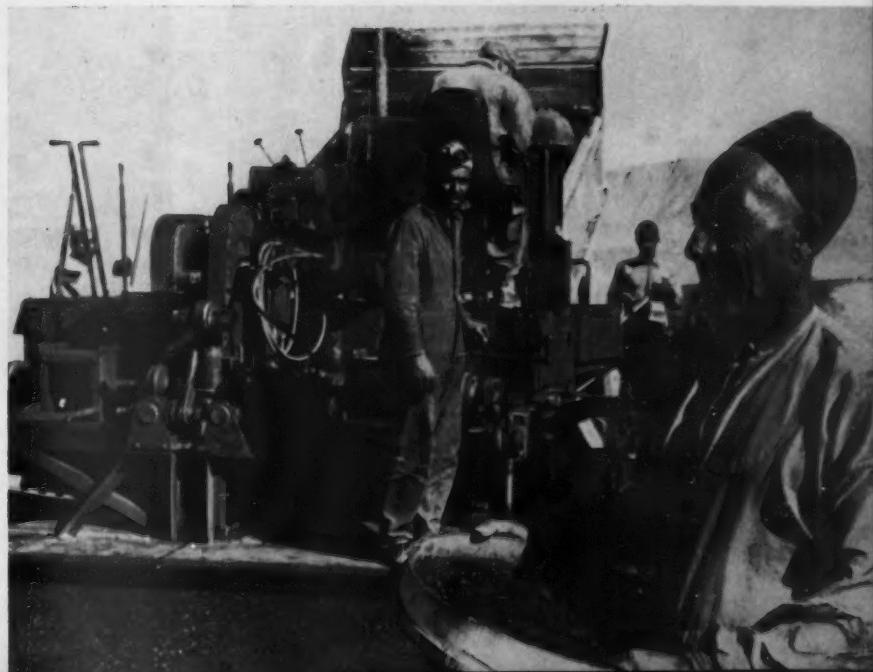
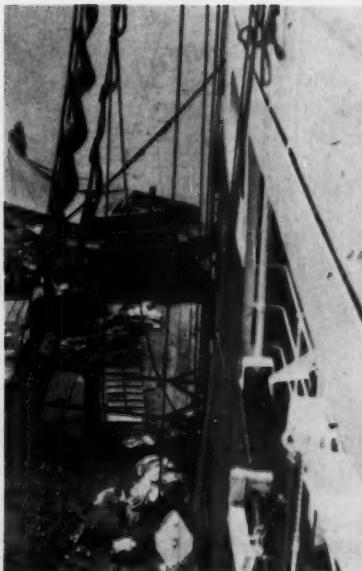
A major program of rehabilitation and expansion for the *Pakistan Railroads* is essential to the economic future of Pakistan. West Pakistan is almost entirely dependent on rail travel and freight transport, and East Pakistan carries about one third of its total traffic by rail. The World Bank has made two loans to improve this system. The first, made in 1952, was for \$27.2 million and was used primarily to finance the introduction of diesel locomotives. The second loan of \$31 million is for replacement, improvement, and expansion of both the East and West Pakistan railroad systems. Wolfe, Barry & Partners, of London, England, are the engineering consultants.



A banana boat loading pier at Guayaquil, is an important feature of the *Ecuador Port Project*. It is being financed by a World Bank loan of \$13 million. The new port facilities will enable larger ships to reach the port without lightering. Increased trade will be handled with less congestion. Parsons, Brinckerhoff, Hall & Macdonald (now Parsons, Brinckerhoff, Quade & Douglas), New York, N. Y., is the consulting engineer.



This is the *Bokaro Thermal Power Plant*, a new 150,000-kw station. It is a part of the Damodar Valley Corporation (DVC), development in the heart of India's heavy industry complex. A recent World Bank loan of \$25 million will enable the DVC to add another 75,000 kilowatts of generating capacity by 1960. Kuljian Corporation, of Philadelphia, is the consulting engineer.



Construction of 1530 miles of the *Iran Road Project* at a total cost of \$185 million will require the largest single loan for road construction yet made by the World Bank. It will provide \$72 million. A team of four consulting engineering firms, Kampsax, of Denmark; Societe Etco, of Iran; Ammann & Whitney, of the U.S.; and Societe Sauti, of Italy, has been formed to perform planning and supervision of this project. Shown here is one of the first construction crews at work resurfacing one of the badly deteriorated main highways. The U. S. Bureau of Public Roads is assisting the nation's Ministry of Roads in setting up a maintenance organization.

The Consultant and the Computer...

A Study of Feasibility and Application

WILLIAM T. GAY, JR.
Head of Computation Section
Fay, Spofford & Thorndike, Inc.

CIVIL ENGINEERING FIRMS that investigate the merits of electronic computers for their own use soon find that the anticipated aura of mystery fails to materialize. Instead, the process closely resembles a typical engineering study. At least it should, for the elements are very similar — learning facts about equipment, determining preferred methods, establishing organizational needs, and analyzing costs. If there is any appreciable difference, it is in the degree of emphasis that is placed on cost and the possible disruption of staff organization. These are the most questionable facets of electronic computation. Both warrant close study, but they should not be the sole criteria. The stakes are too high and the outcome too important.

How to Study Computer Feasibility

The mechanics of a study on the feasibility of a computer are not complicated. One man can gather most of the facts and, in the process, be indoctrinated in at least the basic training needed for electronic computation. If the outcome of the study is favorable he can become the nucleus of a section. That is the way it worked at Fay, Spofford & Thorndike, Inc., and the approach proved to be practical and economically sound.

The FS&T study emanated from one question, "Should this firm engage in electronic computation?" Others soon followed relative to costs, applications, the make of computer, the staff, programming, and organizational changes. Though most were answered during the study, some — especially those pertinent to the staff — were deferred until operating experience indicated the answers.

One engineer, under the supervision of a director of the firm, was assigned to learn the principles of electronic computation, the mechanics of different machines, and the type and volume of work that could be allocated to them. Within three months the first report was in, compiled from data in publications and manufacturers' brochures, from

trips to existing installations, and from reports on sample problems submitted to computer manufacturers and to service bureaus.

Naturally, some questions could be answered at this point while others could not. Further study established the capabilities of the different digital computers in relation to the types of problems normal to the firm. A tentative selection of a computer that seemed most suitable to the firm's work then was made. Taking an actual project as a sample, the total man-hours expended in completing certain operations by manual calculation was compiled, and the hours of machine time that would be required to do the same work was estimated. Knowing the number of similar projects completed during the past year, it was easy to



Bridge engineer checks results of computations performed by digital computer as they are tabulated.

estimate relative cost figures for that period and, at least in part, to justify the investment for a machine before actually having one installed.

The question of lease versus purchase offered little difficulty. Statistics compiled by manufacturers indicated that 90 percent of the machines in use were on a lease arrangement. Economics favors leasing; so does the tax law. Leasing also avoids the problem of estimating machine obsolescence — an important consideration in view of the rapid advances that are being made in computer designs and performance.

However, there was no way to evade some unknown factors, such as the number of engineering projects that would be undertaken during the coming years, their characteristics, the scope of calculations entailed, and the availability of appropriate programs. These were evaluated as well as possible from past experiences and future prospects. A report then was made to management that, if it went ahead with electronic computation, it would have to accept some nonproductive computer time during a development period in which programs for a diversity of engineering work could be prepared.

After reviewing the report and weighing its ramifications, management gave the go-ahead. From a detailed study of the five electronic computers available for a monthly rental of under \$2000 and suitable for civil engineering, the field was narrowed to the Bendix G-15 and the Royal-McBee

LGP-30. Other civil engineers tended to favor the Bendix — without doubt the best choice previous to the availability of the LGP-30 — and, as a result, a strong civil engineering users group had been formed. However, investigation showed that for FS&T requirements the help obtained from the Bendix users group would be quite limited. Thus, the advance in computer technology represented by the ease of programming and versatility of the LGP-30 over the Bendix outweighed the advantage of the latter's strong users group.

A Royal-McBee LGP-30 computer was ordered under a lease arrangement, and an engineer was sent to a programming school for two weeks. This preliminary training was supplemented by work on a locally available machine, pending installation of the new machine. Primary effort at this point was concentrated on programming.

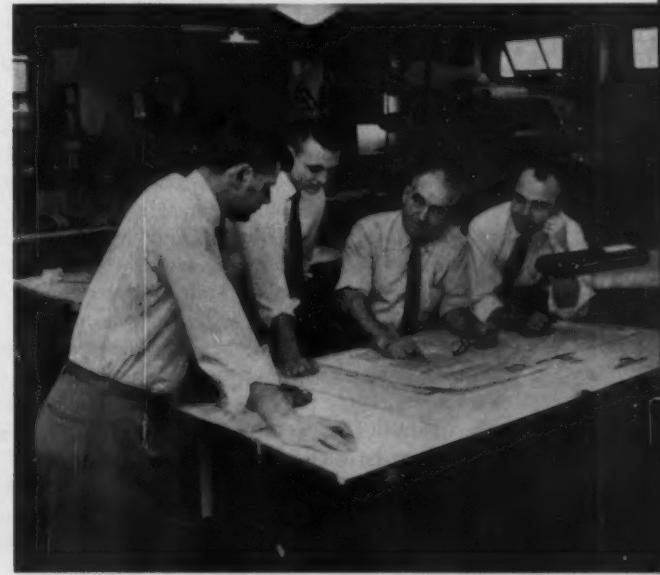
Organizing a Computer Section

From the two most common methods of setting up a computation section — the open shop in which various staff engineers alternate their time on the computer, and the closed shop in which one section is permanently assigned to do all computation — FS&T chose the latter. The specific intent was to develop programming proficiency as fast as possible and, at the same time, to build up a library of basic programs.

As one program was completed, all applicable production work was routed to the computer sec-



Bridge engineer checks tabulated computations with head of computation section, who originated program.



Department head, who has been briefed on computer procedures, educates staff on use of the tabulations.

tion. Once the types of problems solved most efficiently by the computer were completely programmed, other types less complementary to the machine, but still economically applicable, were undertaken. In this manner, nonproductive time gradually was reduced and the advantages of electronic computation became more evident.

Disseminating Computed Data

Depending upon the responsibilities assigned to it, a computation section may operate within a firm in any number of ways. It may be classed as a separate department, with each group of engineers notified of programs available and relying on department heads to make use of them. Or it may be integrated into each department, a system in which a man trained in electronic computation is assigned to serve within each department as a coordinator and liaison man. Regardless of the method adopted, cooperation is vital. Experience invariably emphasizes the importance of indoctrinating as many engineers in a firm as possible in electronic computation. To do otherwise appreciably delays full utilization of a machine.

Program Exchange

Though it might be possible to justify the cost of a computer using only those programs prepared and distributed by agencies or exchange organizations, this procedure could mean extending the time period of low machine utilization if the availability of particular programs is limited.

For example, POOL, the LGP-30 users group, only recently formed to facilitate the exchange of programs among members, could not yet provide a large number of programs. This takes time, for new programs submitted to POOL are checked out and reviewed by several POOL members before being recommended for distribution. Beyond this, a monthly newsletter published by Royal McBee and a yearly POOL convention provide the only means of maintaining contact among members. While the program library is growing rapidly, it probably never will serve as a single and complete source for all the work done by computer in a civil engineering firm.

Thus, there is a definite need for trained programming personnel within the company. Assume, for instance, that a program for calculating earthwork quantities is received through exchange. Before it can be used on a specific project, it must be analyzed to ascertain exactly how it works. Quite likely it will have to be altered to meet company needs and methods.

Conversely, to offer a program to other users involves extra costs and extra time because more extensive detailing usually is required. An addi-

tional time and cost factor of about 25 percent should be assumed. This fact, compounded by a natural reluctance to give away something of value, retards exchange programs to some degree. However, as engineers gain a broader viewpoint on this subject and become aware of the long range benefits, the picture is quite likely to change.

The Computer and the Staff

Engineers themselves, though they will readily deny it, may prove to be the hardest group of all to convince that electronic computation is a boon to the profession. Some, perhaps, feel like the machinist whose sense of job security is disturbed when production is automated. Others may display resentment, frequently subconscious, against the idea that a machine can do a job for which they have had many years of training. Whatever the reason, the opposition often is tangible and must be reconciled before a computation section can be integrated into the operations of a consulting engineering firm to its fullest.

Computers Are in the Consultant's Future

No matter how distasteful the computer may be to its opponents, it is here to stay. A report issued late in 1958 showed 7200 computers installed in such fields as government, utilities, research departments, and colleges. Over 50 consulting firms now use them. More are certain to do so.

Even at this stage, some firms have experienced pressure from governmental agencies to reduce engineering fees when electronic computers are available to perform routine calculations. On the contrary, there is good reason for firms using computers to receive higher fees because time normally expended on manual calculations can be expended in evolving alternate designs and verifying the advantages of the one selected. Be that as it may, there is evidence to support the trend toward regarding electronic computers as indispensable tools for large civil engineering projects.

However, pursuing the future in detail is risky. Certainly, not every engineering firm can afford to establish its own computer section. Even if it could, there still remains a staff problem. Thus, the idea of limiting electronic computation in order to hold a staff together cannot be discounted completely. It may be that the smaller engineering office will employ a service bureau to handle its computation work, or unite with other offices handling similar work and engage in a mutual computation program. One thing is certain, no engineering office, whatever the size, can afford to ignore the important developments being made in electronic computation. They already are having a profound effect on the profession. ▲▲

Why Let the Low Bidder Fix Your Fee?

FEE IN PERCENT

DONALD R. GOODKIND

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COST IN DOLLARS

ONE OF THE MOST difficult and important problems encountered by the consulting engineer in negotiating an engineering contract is establishing a reasonable fee for the services to be rendered.

CE exclusive
Members of other professions do not seem to have this problem, or, at least, their version is easier to solve. The doctor or the lawyer arrives at his fee by some simple empirical formula, known only to himself, in which the two prime factors would seem to be his own reputation and the ability of his client to pay. Rarely do we hear of a client disputing the amount of the fee, and there is never a suggestion of competitive bidding by the professionals and seldom any shopping by the client.

For the engineer the procedure is not so simple. He must be ready to defend his proposed fee against objections and to "negotiate"—an euphemistic way of saying "reduce the amount." Where the client or his representative is accustomed to purchasing services or materials by competitive bidding, the methods used to determine a fair engineering fee often are misunderstood and usually viewed with suspicion. Many clients fail to see any difference between engaging an engineer to do the design plans and specifications and hiring a contractor to undertake the construction.

This attitude has been induced to some extent by the increase in both the number and size of consulting engineer firms in recent years. Originally the consulting engineer was an advisor in some specialized technical field. A client needing advice or a solution to a particular problem had only a few consultants to pick from and, having chosen one,

was prepared to pay the fee requested. Today there are many engineering firms qualified to do a wide variety of jobs in just about any field of engineering, and the client is hardly to be blamed for resorting to the law of supply and demand.

Society Fee Schedules

In an effort to substitute professional pricing for competitive bidding many engineering societies, national and local, have drafted manuals classifying the services to be provided, listing types of fees suitable for various services, and stipulating appropriate ranges of compensation as determined by the size and intricacies of the project. The heart of each manual is usually a fee chart with a curve showing a relationship between construction cost of the project and the recommended engineering fee, expressed as a percentage of construction cost.

A typical chart has been published by the American Society of Civil Engineers in its manual "Private Practice of Civil Engineering—For the Use of Engineers and Clients." To provide data for this chart, a questionnaire was sent to civil engineers in private practice throughout the nation. Their answers to questions concerning their practice in arriving at fees were used to provide points through which an average curve was drawn.

Since the curve was established using the construction costs prevailing during the period of the survey, adjustments must be made for the variations in costs that will have occurred by the time the chart is consulted, and further adjustments would seem to be called for whenever there is any change in the relationship between construction costs and

engineering design costs. Furthermore, while various types of projects were covered in the answers to the questionnaire, these average conditions may not be representative of the specific project for which the chart is consulted.

In fairness to the creators of fee charts, it must be admitted that most manuals warn the reader that the charts are general recommendations and should not be used indiscriminately. But many people prefer to have someone else do their thinking for them, and it is all too easy to accept these charts as firm price lists instead of recommended averages or minimums — especially when they appear under the seal of nationally known engineering bodies. All too often in negotiating a fee for services, the consulting engineer will pull out the sacred fee chart, chase the estimated construction cost straight up to a collision with the curve, and then slide sideways to find the percentage that will establish appropriate compensation for a professional job. We might call this nomographic negotiation — or cartographic compensation.

Pitfalls Evident

The engineer who accepts this procedure will discover that it involves no negotiation and all too little compensation. One of the factors in the fee — the construction cost — is out of his control, for it is based on the unit prices offered by the low bidder. The engineer's design can provide the quantities of the various items, but it is the accepted low bidder who finally determines the total cost of the project and thus becomes the master of the engineer's fate in the matter of fee.

The low bidder is probably the last man who should have this power of decision, for his price may be motivated by many foreign factors. He may have made a bad estimate of the difficulties of the job, or he may have slipped up in figuring labor, equipment, or material costs. He even may be taking the job at a loss to keep his plant and key men employed. But when his bid, as often happens, is considerably lower than the average, it indicates that his estimate of costs is at variance with the opinions of the other contractors who have analyzed the job. He may be right and they may be wrong — but not always.

What is an engineer profited if he applies the graph only to find his fee based not on the average construction cost but on the miscalculations of a lone contractor? The contractor may have some opportunity to control his destiny. If he is clever enough, he may make some money or at least reduce his losses. But the engineer's goose is pre-cooked and quick frozen.

In the past year construction costs have dropped in several fields, and as a result the unfairness of

percentage fees has been brought home sharply to consulting firms. Many an engineer negotiated a percentage fee, applied it to a reasonable estimate of cost to determine his proper compensation, and then budgeted his work to produce the best possible set of engineering plans. But time elapsed between the engagement of the engineer and the letting of the construction contract. When bids were received the actual construction costs were found to be 15 to 20 percent under the engineer's estimates — and his fee was reduced accordingly. Since a consultant usually cannot anticipate more than 10 percent for profit, he was forced to lose money in the proper performance of a professional service. This fate is especially ironical where the engineer has, by added study and applied ingenuity, devised plans that permitted and encouraged low bid prices. A reduced fee is the reward for professional superiority.

True, the opposite can happen and often does. If no daring contractors take part in the letting, the low bid may be considerably higher than the engineer's estimate. This may be gravy for the engineer, but to his client it is adding insult to injury when he has to pay a higher engineering fee on top of the higher price for the construction.

In spite of these obvious objections, almost every professional group has a committee busily at work revising old fee curves — and preparing new ones for heretofore neglected branches of the profession. Much effort also is being expended in attempts to educate prospective clients in the acceptance and use of these guides. Truly, with the preacher in Ecclesiastes, we can cry, "of making many books there is no end; and much study is a weariness of the flesh."

Alternatives Little Help

Why, in view of the inherent weaknesses, should the chart-making process continue? Maybe the prime reason lies in the lack of reasonable alternatives. The cost-plus method of reimbursement has fallen into disrepute because of its abuse in a few government contracts. And a client engaging the services of a consulting engineer for the first time hesitates to accept a cost-plus proposal because he feels it might leave him at the mercy of a careless or greedy engineer.

For his part, many an engineer dislikes the extensive bookkeeping and constant surveillance of his operations often associated with a cost-plus arrangement. Some clients require elaborate reports, in triplicate, showing all salary charges, expense vouchers, and other reimbursable items. The client even may demand affidavits testifying to the honesty of each charge. This does not make for a professional relationship between engineer and client. Not only the consultant's clerical help



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117

Schedule "A" Addendum III -- Schedule of Unit Fee Prices, May 1, 1959

Description	Unit	Fee Price
Excavation, Borrow or Fill	C.Y.	\$ 0.80
Sewer Pipe (All Types) 36" & Under	L.F.	5.00
Culvert Pipe (All Types) over 36"	L.F.	15.00
Corrugated Plate Pipe (Arches -- All Sizes)	L.F.	50.00
Class 1, 2, and 3 Concrete	C.Y.	50.00
Bar Reinforcement for Concrete Pavement	Lb.	0.15
Stud Shear Connectors	Each	0.50
Open Steel Floor	S.F.	7.00
Metal or Aluminum Railing	L.F.	13.00
Concrete Pavement (All Types)	C.Y.	14.00
Top Course -- Asphalt Concrete (All Types)*	Ton	10.00
Top Course -- Bituminous Macadam, Types 1 & 2	C.Y.	10.00
Membrane Waterproofing	S.Y.	3.00
Bituminous Materials (for all uses and job applications)	Gal.	0.20
Chain Link Fence (All Types)	L.F.	3.00
Bridge Bearing Pads	S.F.	5.00
Railroad Approach Warning Signs -- Reflector Type	Each	100.00
Rubber Joint Material	Gal.	40.00
Protective Coating for Concrete	Gal.	5.00

*Includes patching, leveling, trueing up courses

Typical highway project items selected from schedules of the New York State Department of Public Works.

but his engineers as well can consume an inordinate amount of time trying to allocate correctly the various cost items. Files become jammed with paper, the cost of which can exceed the billings.

Another alternative is the lump-sum fee. This can be acceptable to the engineer if the project is well-defined and he does not anticipate any time-consuming changes in plan. With such an agreement, the engineer knows what his compensation will be from the start of his job and can budget his efforts to produce a design that will yield him a reasonable profit. More often than not, however, an engineering project cannot be defined accurately at its inception so as to cover all contingencies. Changes will occur during the course of the design, and if these are at all significant the lump-sum fee soon will be out of line with the actual costs. Attempts to obtain extra compensation for changes can lead to arguments. Even if the original agreement includes a formula for adjusting the fee, it may be difficult to apply, particularly if it involves an alteration of the whole basis on which the engineering fee was established.

At least the percentage of construction cost fee avoids these problems. To the client it means that his engineering costs will maintain some reasonable relationship to the size of his project. Should the scope of the work change, the fee is adjusted

automatically. And, it generally is accepted that in a particular type of undertaking, the amount of engineering usually bears a somewhat direct relationship to the construction cost of the work.

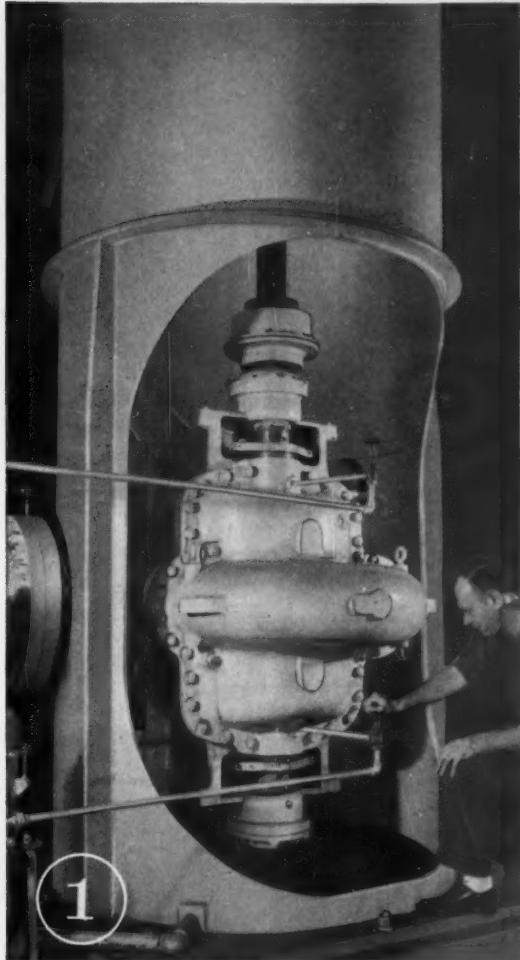
Possible Solution

If the construction cost is accepted as the most workable basis for fee determination, how can this method be freed from its great sins — dependence on the low bidder and fluctuating prices?

It is wrong to leave the engineer, throughout the whole study and design period, ignorant as to how much he will be paid for his services. Fearing the worst he is not likely to make, cheerfully, that "just one more study" suggested by the client, nor is he likely to spend much time searching for alternatives that will cut the cost. Thus, it would be better for all parties if the engineer were able to estimate his fee in dollars and cents, with a fair degree of exactitude, at an early stage.

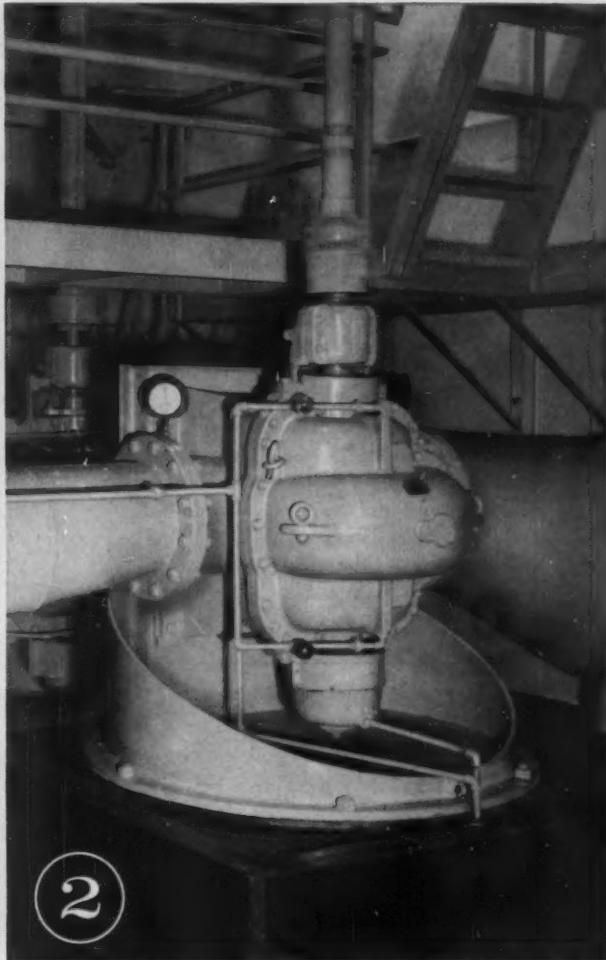
The solution is to have the client and the engineer agree on an estimate of cost when the plans are sufficiently advanced to permit it. This can be accomplished by establishing, in advance, a schedule of unit prices, which are made a part of the engineering agreement. This scale could be the average unit prices bid for similar work in the same area over the preceding year, with reasonable

ALLIS-CHALMERS



1

Vertical mounting with barrel supporting motor provides for discharge at either 90 or 180 degrees to the suction.



2

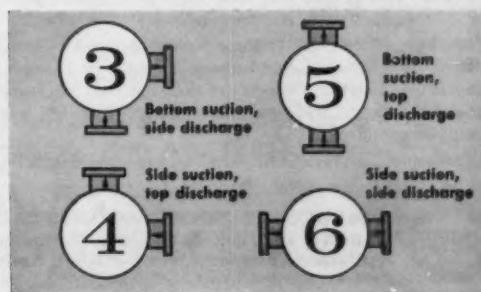
Mounted vertically, A-C pumps can be driven with motor on another floor — discharge at either 180 or 90 degrees to the suction.

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A-1217

judgment exercised in evaluating the relative character of that previous work for such factors as quantities, accessibility, and complexity. It can be anticipated that the actual bid prices will vary from the established prices, but this is immaterial to the matter at hand, for the purpose of the agreement is to arrive at an engineering fee, not to estimate the construction costs. The acceptance of an agreed schedule of unit prices insures the client against paying a higher engineering fee simply because construction prices rise, and it protects the engineer against a reduced fee if prices should drop.

If significant changes in the scope of work occur during the progress of the plans, the estimate can be adjusted when the final plans are completed. The quantities then can be determined either by a verified take-off or by field measurements. The scale of unit prices originally agreed upon would be used. Should some special items be involved for which unit prices cannot be established, it can be agreed that these are to be left for determination until the receipt of bids, when an average of all bids, or the three lowest, for these items can be used.

This procedure already has been adopted by some official bodies and private clients. A noteworthy example is the Department of Public Works of the State of New York, where established unit prices for all items of work (representative

items for highway projects, selected at random, are listed on page 118) are made a part of the agreement for engineering services. For items not included in the agreement, the District Engineer is empowered to approve unit prices reached by agreement between him and the consultant.

Pre-selection of unit prices makes it possible for the engineer to approximate his fee with reasonable accuracy while design work is still in the preliminary stage and permits him to budget an engineering program so that the client actually gets what he pays for. Frequently the consultant also is able to get a much better idea of his fee even before he negotiates the engineering agreement.

Pre-selection of unit prices also protects both the consultant and his client against the vicissitudes of unusually high or low contractor bids. It helps set a professional fee for professional services.

The professional societies can help to bring this desirable change about by putting less emphasis on the percentage fee-construction cost relationship and underlining the necessity of establishing reasonable unit prices at the time an engineering agreement is negotiated. Then the determination of the exact point of intersection on a fee chart will no longer be the meaningless gesture that our unthinking adherence to an ill-considered practice has almost sanctified. □ □



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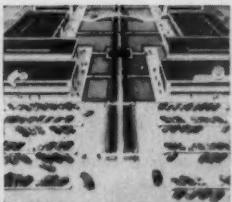
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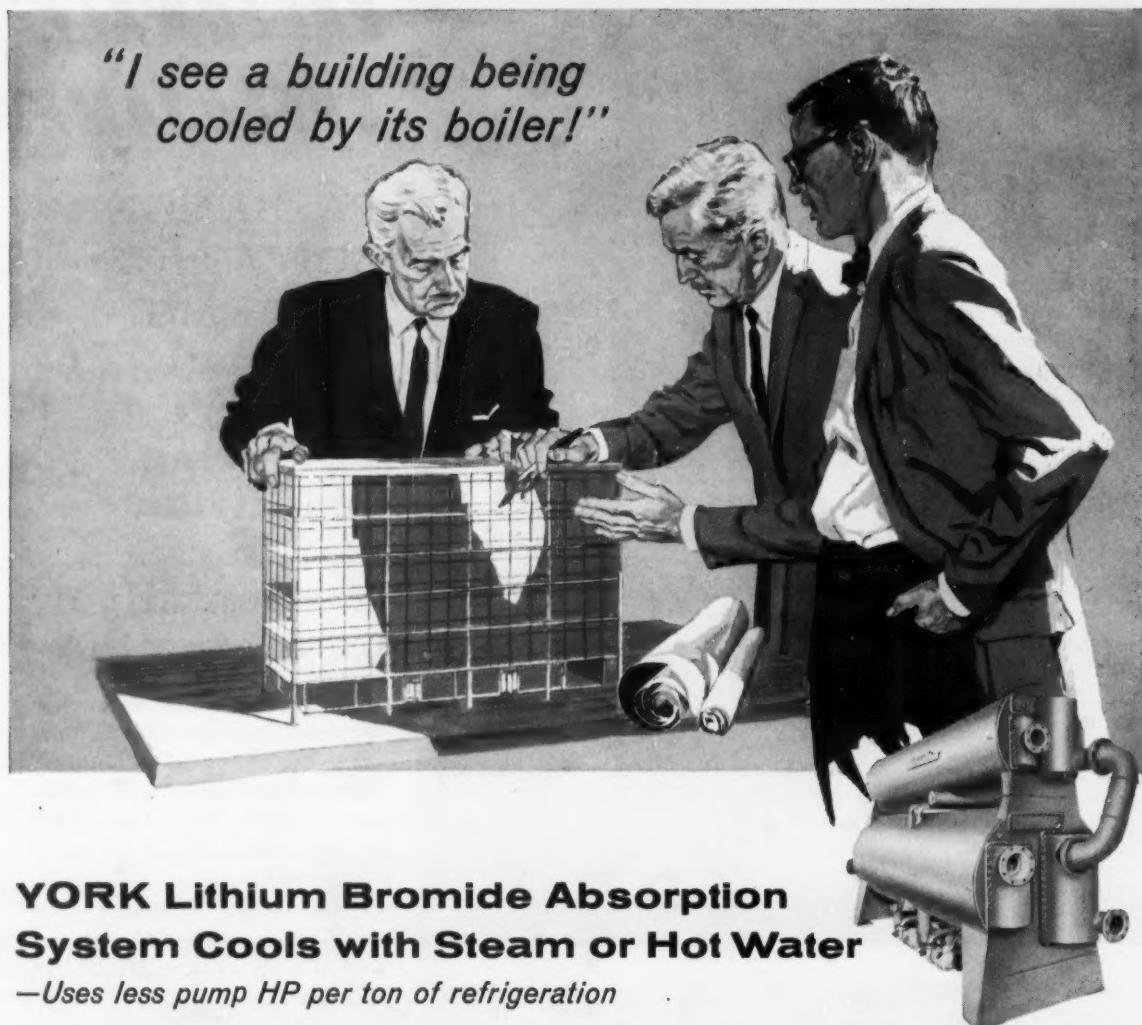


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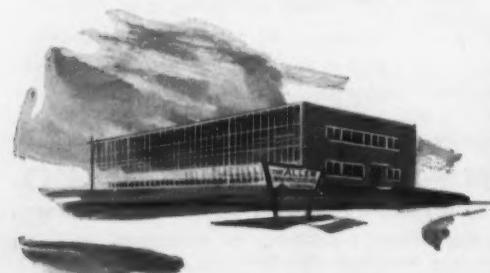
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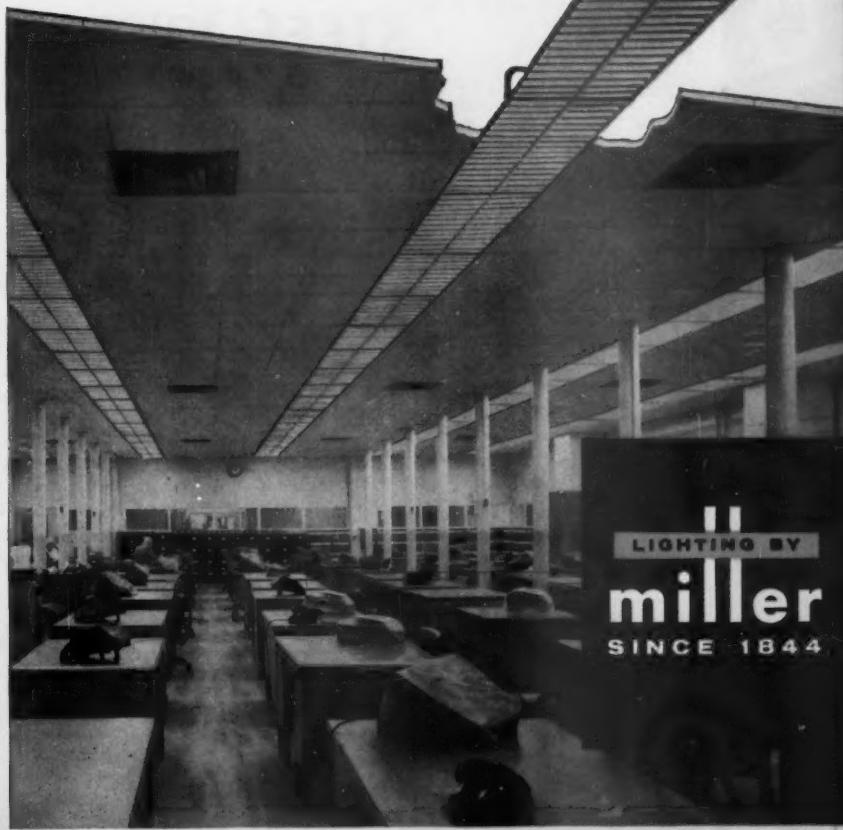
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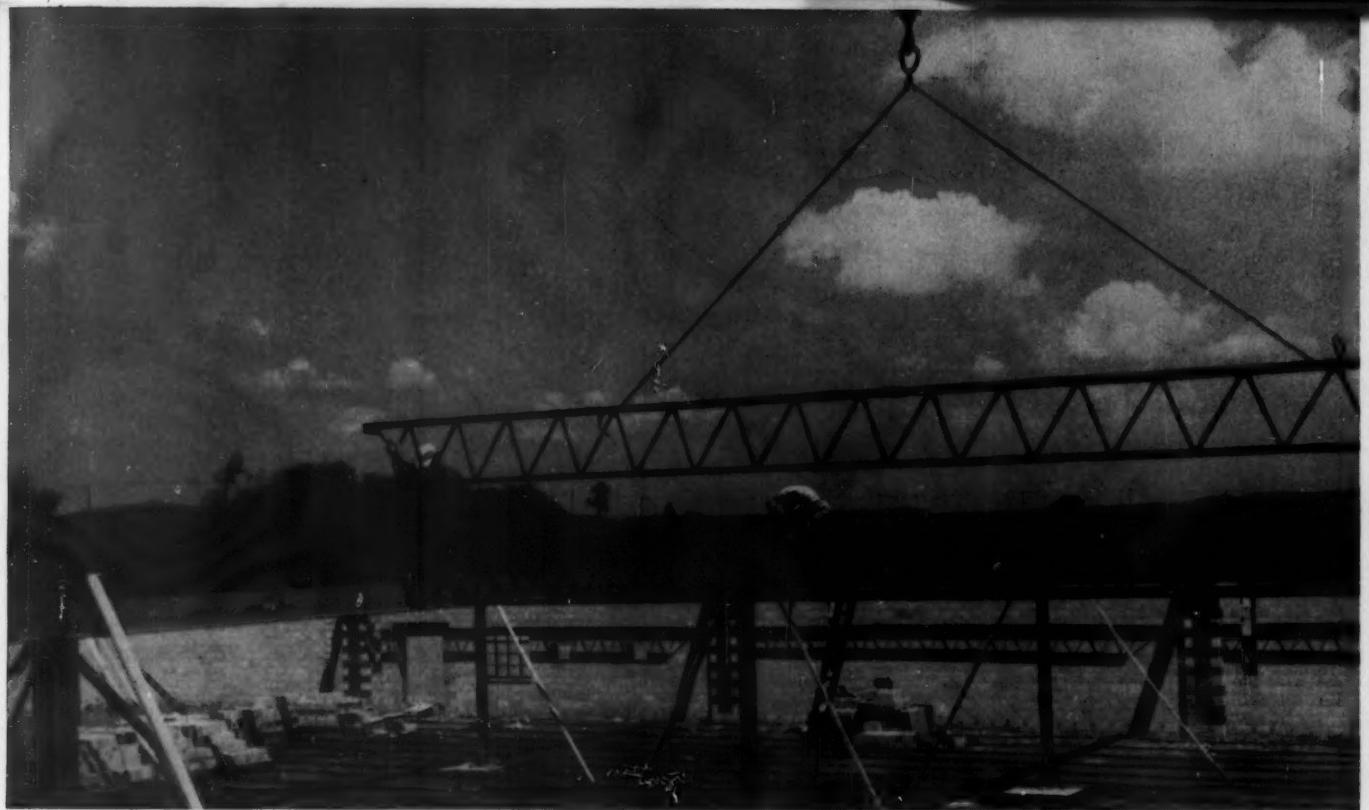
To: Dept. A-260
THE MILLER COMPANY, Meriden, Conn.

I'd like additional information on how I can obtain comfortable, high footcandle lighting at lower cost with Miller Aluminum Troffers.
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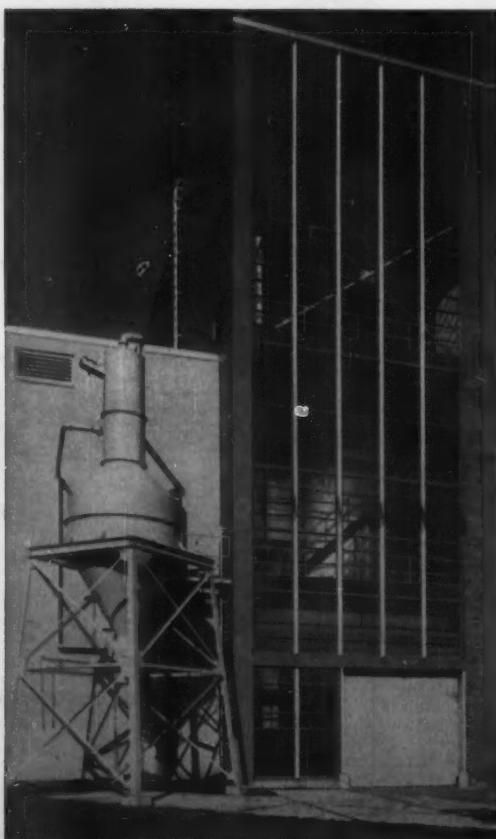
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TRUSCON VISION-VENT® Window Walls with Truscon Intermediate Projected Type Windows and Screens were used in the construction of the West Hartford Incinerator, West Hartford, Conn. Architects: Metcalf & Eddy, Boston, Mass. Contractors: Associated Construction Company, Hartford, Conn.



TRUSCON "O-T" STEEL JOIST was used in this construction, Attil W. Wampler & Sons Furniture Store, Baltimore, Md. E. S. Armacost & Son were the builders and designers. Truscon Wire Fabric, Bars, Structural Steel, Steedeck Series 57 Doors, Commercial Projected and Security Steel Windows, are other Truscon products that have been specified for the job.

TRUSCON 24" FERROBORD® ROOFDECK provided fast coverage, full protection in the construction of the General Electric Company, warehouse and office building, King of Prussia, Montgomery County, Pa. Architect: George M. Ewing, Philadelphia, Pa. Contractors: Nason & Cullen, Inc., Philadelphia, Pa.



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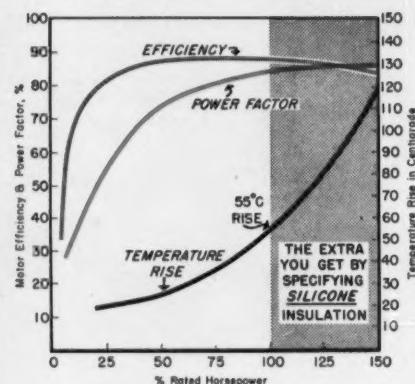
These new motors, insulated with Dow Corning Silicones, have a built-in reserve to carry overloads of twenty-five to fifty percent above nameplate horsepower rating. Here's what this means to you:

Simplified Motor Specifications: Specify motors that are silicone insulated for high service factor. With nameplate horsepower ratings identical to nominal loads, these motors will handle temporary, or even continuous overloading. No need to calculate maximum possible load and add a safety factor. It's already built in.

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Field Notes

MARJORIE ODEN,
Eastern Editor

A Look at the Reports of the Automotive Safety Foundation

JOSEPH MATTSON, Automotive Safety Foundation president, recently stated that the Safety Foundation is in no position to recommend the use of consulting engineers or to recommend that states do their own design work in lieu of retaining consultants ("Heard Around Headquarters," Jan. 1960).

He added, in a conversation with Ralph Westcott, Consulting Engineers Council president, that "We [the Safety Foundation] studiously avoid detailed design recommendations in our studies."

Of course, Mattson excepted the well-known study of the Pennsylvania highway department in which the Safety Foundation advised that ". . . the department should begin now to assume a greater portion of the design within the organization. The shift could begin by surveying all locations and preparing construction plans for all widening, resurfacing, and reconstruction. As the personnel situation is strengthened, the design of all rural roads and, progressively, principal state highways should be performed by the department."

CONSULTING ENGINEER has made a study of available Safety Foundation highway department studies (20 out of 28). Among the studies currently being conducted but not completed are those in Wyoming, Iowa, South Dakota, and Missouri.

The subject of who does highway and bridge design generally was skirted in the Safety Foundation reports. No report said that states "shall not" use consulting engineers, but a number said that the states should do the design work. In a few states, the use of consultants was specifically mentioned.

In many states, the Safety Foundation wants highway departments to get better accounting methods. This need also has been recognized by the American Association of Highway Officials and by any organization that has tried to find out what design by state-employed engineers actually costs.

Also pointed out in many of the Safety Foundation reports was the need for more college graduates and registered professionals on state engineering staffs.

References to Design Work

The only specific references in the Safety Foundation reports as to who should do (or does) design occurred in reports for these states:

¶ Kentucky — "Plans are completed by the Division of Design which also prepares the contracts and takes bids. It [the Department of Highways] is not an ideally efficient agency but, as reorganized and strengthened during the last 18 years, it has administered the development and operation of the

expanding state-minded system in a generally satisfactory manner.

". . . the District Offices should do the designing for all road projects on the recommended County Arterial Systems. Because of the more elaborate roadway facilities and state-wide continuity required on the recommended state trunk-line routes, design of these and of all bridge structures would remain in the headquarters offices of the Division of Design."

And among the recommendations for the Kentucky highway department was the statement that ". . . all detailed construction plans and specifications would be initiated by the county or district and should be approved by the Department of Highways."

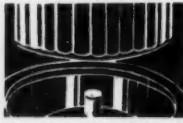
¶ Maine — "The State Highway Department has a good organization which could be increased to do the whole job."

¶ Michigan — Some of the requirements listed for "good highway administration at the county level" are "preparation of construction plans and specifications for all contractual work . . . extension of contractual highway services to small cities and villages upon request . . . adoption of uniform accounting practices."

As a further requirement, ". . . the State Highway Department is the logical agency to coordinate



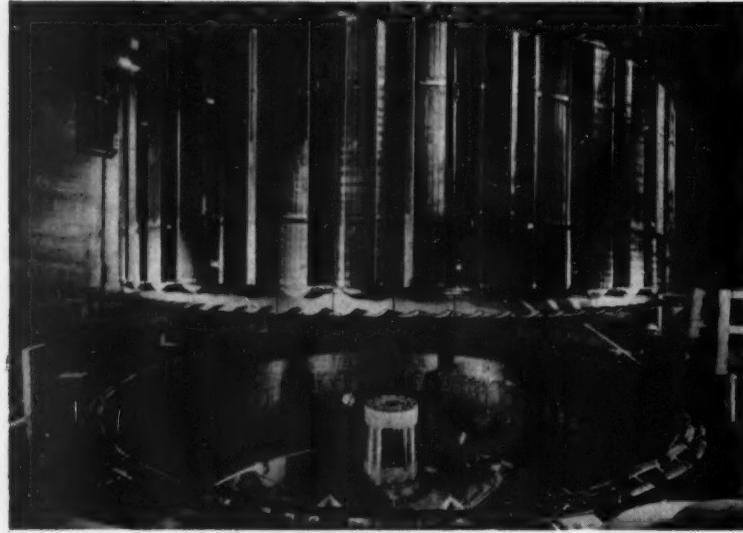
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highway administration on a state-wide basis, to collect and consolidate reports for legislation, to act as a clearing house for highway planning and programming information, and to provide specialized consulting services to counties and municipalities, on request, when personnel is available."

¶ Montana — "The state-aid unit should be authorized to provide technical assistance and advice to counties and cities on problems of road and street location, design, construction, and maintenance."

¶ Mississippi — "All units should be allowed to employ specialists for specific types of work and should be free to negotiate for such services on a fee or contract basis. This particularly applies to smaller cities in need of engineering assistance, for county service to two or more counties, and specific projects by all units. Specific legal authority permitting such negotiation by the state and counties is needed."

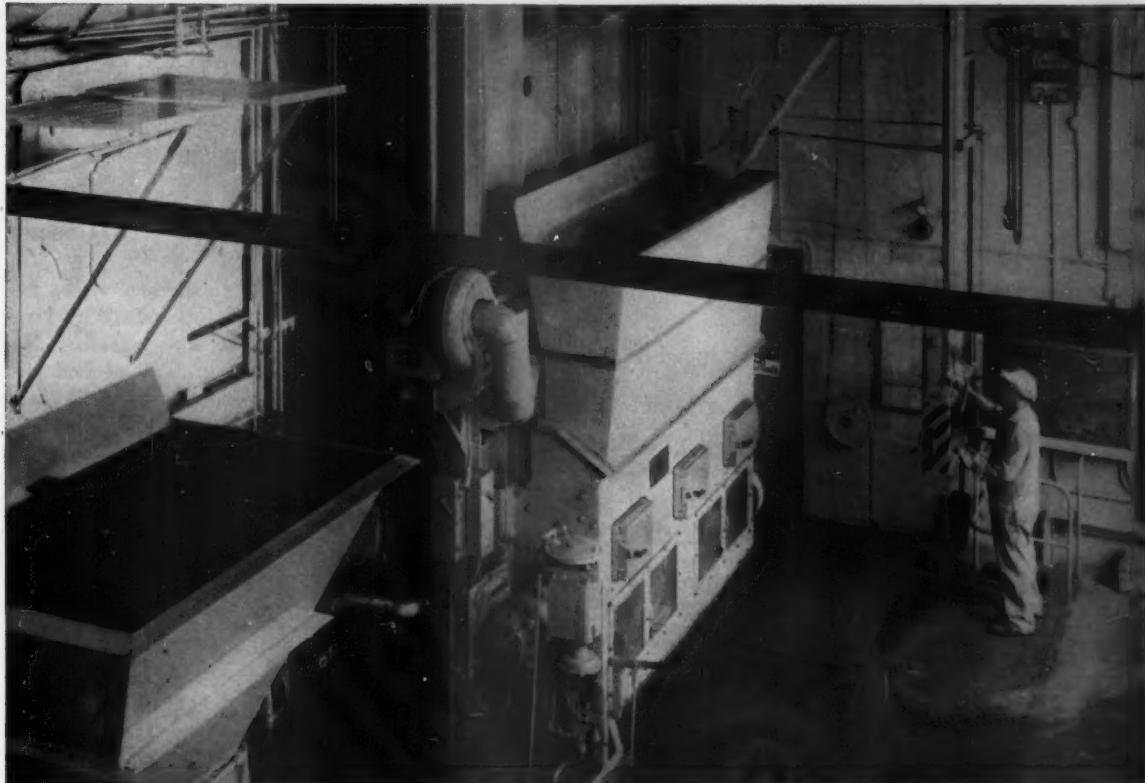
¶ Nebraska — "Traffic engineering could also be extended to include more field service and to participate in highway design."

¶ Louisiana — "Questions on design standards and policies should be determined at the headquarters staff level . . . Preparation of final plans is a headquarters responsibility.

"In smaller cities, where the mileage of streets and the financial requirements are not large enough to warrant full-time engineering service, it is recommended that such technical service be utilized. In parishes organized to operate under engineering direction, the parish engineer should be authorized to give required service."

¶ Washington — "Some of the existing activities of planning, design, construction, maintenance, right of way, traffic engineering, bridges, materials and research, records, personnel, Federal aid, and public relations will be expanded as the program gets under way. More emphasis will be given to planning as it affects all work of the department, making practical use of data de-

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On the line in October 1954, this 40,000-lb B&W boiler, fired by AE Vibra-Grate Stoker, has never had an unscheduled shutdown. Cost of repairs to previous stokers ran close to \$1000 per year.

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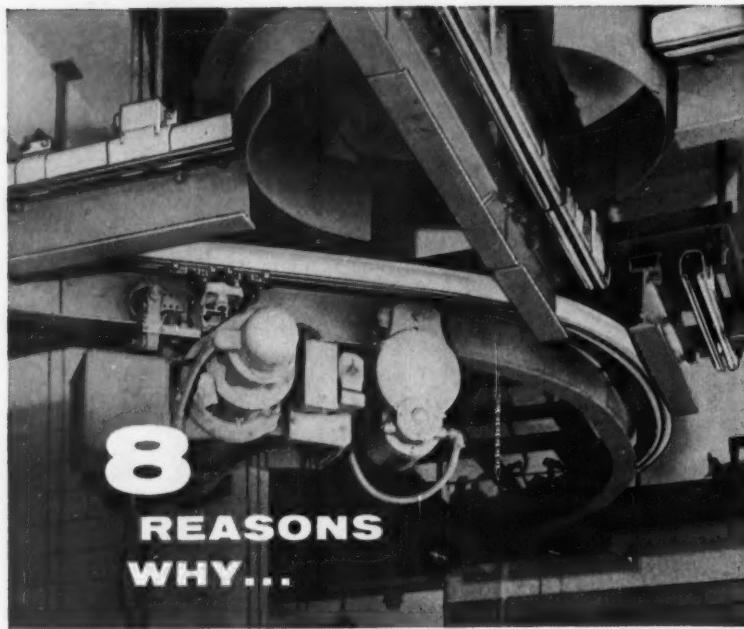
tons of coal . . . just slightly over $\frac{1}{2}$ cent per ton of coal!

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INFORMATION FOR YOU: Bulletins are available on Feedrail 60 Ampere Systems (90 Ampere Intermittent Service); 100 Ampere Systems (150 Ampere Intermittent Service); and Heavy Duty Systems of 225, 375 and 500 Amperes. Write FEEDRAIL, Department CE-2.



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SPECIALLY QUALIFIED REPRESENTATIVES IN PRINCIPAL CITIES

veloped by the Highway Planning Survey, operated jointly with the Public Roads Administration."

¶ **North Dakota**—“There is a general lack of engineering supervision of highway construction and maintenance which would provide more economical and more lasting improvements. Only a few counties and a few cities employ full-time engineers, and not many employ consulting engineers.

“It is reasonable to expect that, in fulfilling these responsibilities [listed in the report], the State Highway Commissioner would receive the advice and counsel of local engineers and officials . . .”

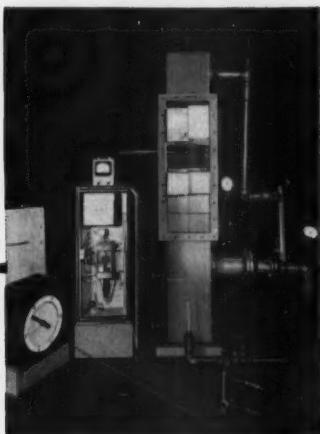
¶ **Oregon**—One of the recommendations for counties was to obtain “the advice of a qualified engineer or technician in connection with specific improvement or operational problems.”

Expand Highway Departments?

On the question of expanding highway departments, Tennessee was told that “There is an acute shortage of highway engineers in Tennessee. To meet an expanded program the Department of Highways will need more.” Kentucky was advised that “To fit the division of planning for this increased responsibility its staff must be built up for engineering analysis.” And Montana, “. . . to handle the known expanded construction program will require an estimated 50 percent increase in the number of technical [including engineers] employees within three years.”

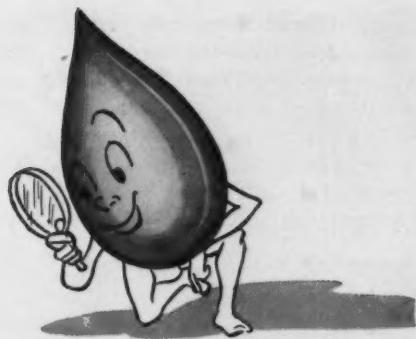
Need for more highway department personnel also was cited in Nebraska, where district engineers need both field and office employees. Full-time engineers also were recommended for cities and counties in many states.

Suggestions that counties and municipalities large enough to afford it hire full-time engineers was made in the Louisiana, Nebraska, Montana, California, and Kentucky reports. The State was asked to provide engineering advice in Michigan.

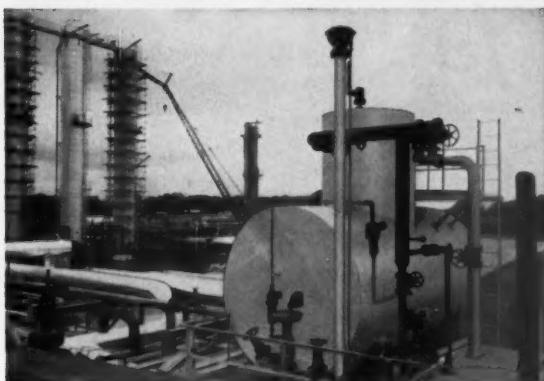


Pilot tray-type deaerator shown with continuous oxygen analyzer in test setup.

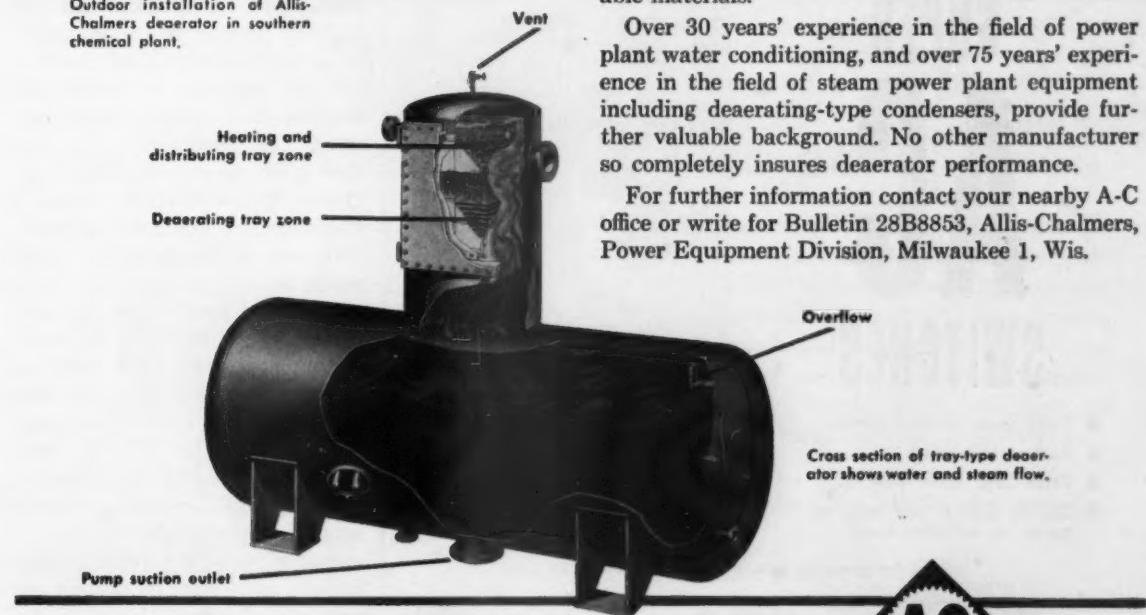
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gan, California, Tennessee, Rhode Island, and Louisiana for areas lacking the population to support a full-time engineer. And the services of consulting engineers were specifically recommended to the less populated areas of Mississippi, Oregon, and Louisiana.

Accounting Methods Inadequate

The need for better and more uniform accounting methods, to keep a close control on costs, was cited

in many of the reports. One of the more interesting examples of poor practice was covered in the West Virginia report.

"Many inadequacies were found in present Commission accounting procedures. Record keeping, cost analysis, and fund accountability should be centralized within the Department on a practical, accurate, and comprehensive basis.

"The newly-opened West Virginia Turnpike is a graphic demon-

stration of the difficulties and high cost of constructing a modern highway in the State. Construction costs alone averaged more than \$1 million per mile.

"In the last 20 years there have been six road commissioners in West Virginia. The frequency of turn-over, regardless of competence, is indicative of the lack of stability resulting from domination or direct control assumed by various of the State's governors.

"Past practices have resulted in interference in programming of funds, demoralization of personnel, and inefficient operation, with a consequent reduction in the value of highway expenditures.

"In management of highways, just as in any well conducted business, record keeping, cost analysis, and fund accountability should be conducted through a central agency on a practical, accurate, and comprehensive basis."

Personnel Qualifications

Two reports, mentioning the caliber of highway department engineers, were interesting. The Kentucky report showed that in 1955 there were 619 men on the engineering staff. "Only 127 of those listed as highway engineers are graduates of an engineering school. Another 138 are registered as professional engineers but are not college graduates. The remaining 354 are neither graduate nor registered engineers. Only a fifth of the Resident Engineers are graduate engineers. Only one of the 11 District Engineers, as now assigned, is college trained, and none of the six Zone Engineers has had such training."

Kentucky is not alone with the problem. In Montana, at the time of the report (1956), "Technical employees number 510, of which 219 are in engineering classifications and 291 are technicians in subprofessional grades. Of the . . . engineers, only 30 percent are registered; more than 60 percent are neither civil engineering graduates nor registered." ▲



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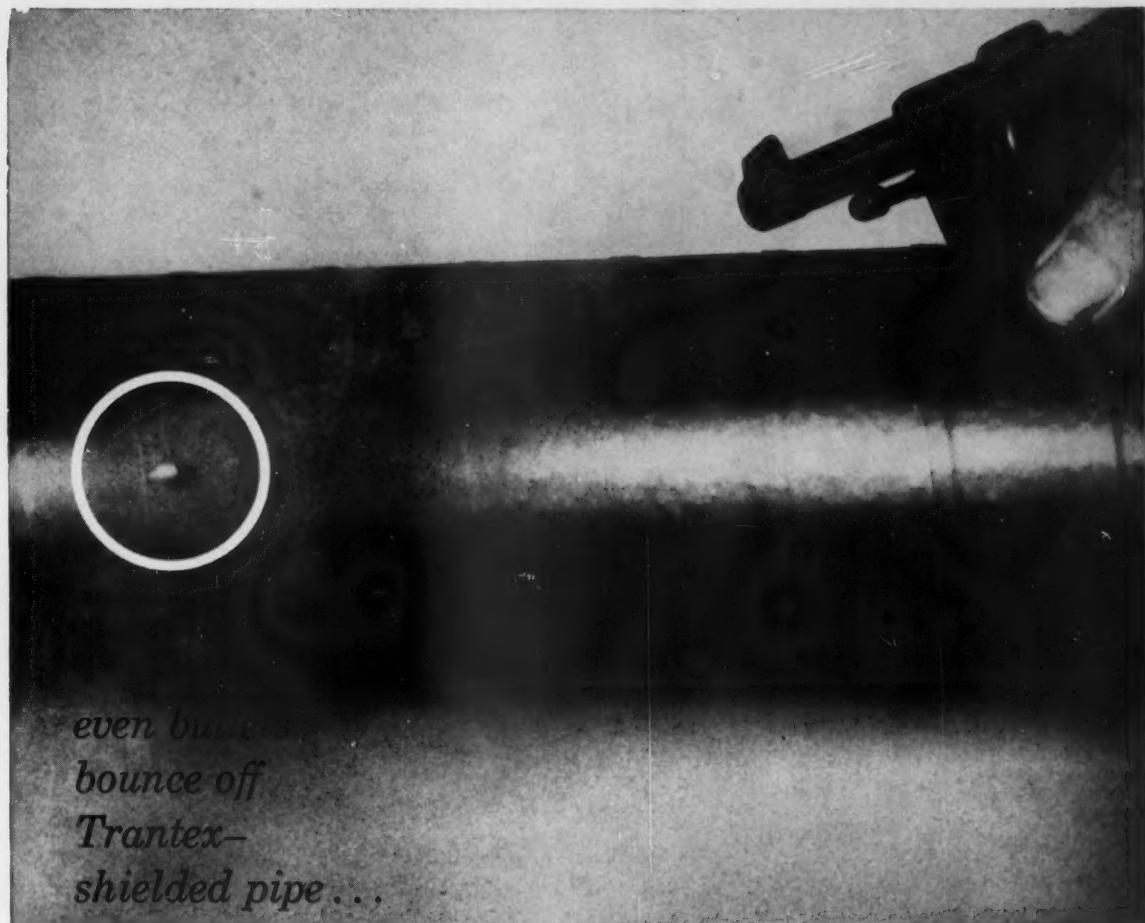
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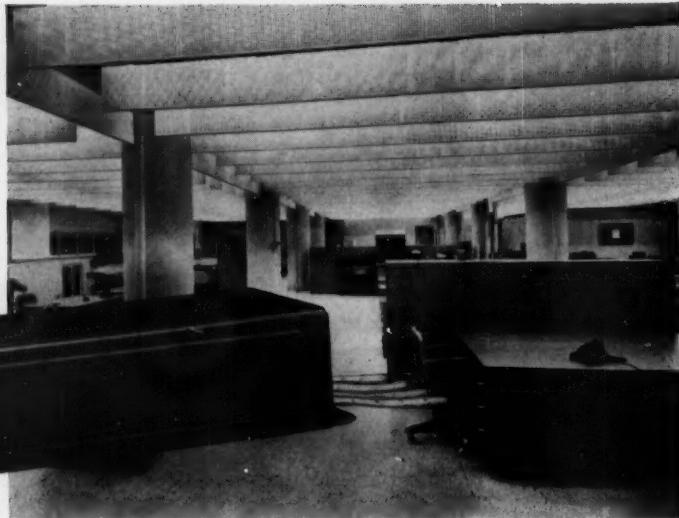
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Report from the West Coast

RALPH S. TORGERSON

West Coast Editorial Representative

Structural Engineers Discuss Ethics

THE Structural Engineers Association of California has been much concerned over the difficulties of interpreting ethical practices, particularly the so-called "grey area" problems. Because they usually do not arise from deliberate action, the Association has sought interpretation of typical, but hypothe-

tical, violations of the Civil and Professional Engineers Act.

Opinions of Interest

At the 1959 annual convention, retiring President Joseph Sheffet reported on correspondence with the State Board of Registration which sought clarification of possible violations of the Act when a non-licensed person engages a licensed civil engineer to perform engineering work. In analyzing two hypothetical situations, Capt. Arthur I. Flaherty, executive secretary of the Board of Registration, explained that the Board does not interpret the Act. It tries to identify the facts in each case and match these facts against the requirements of the Act to determine whether or not a violation exists.

In the first case, it is supposed that a designer undertakes the preparation of plans for a construction project in which civil engineering work is involved. A licensed civil engineer is engaged by the designer to do the civil engineering work. The engineer prepares plans for the work, and they are presented to the client under his signature or seal. Has the law been violated, and if so, by whom?

Flaherty pointed out that the Act does not recognize the term "designer," which, in California, generally refers to one who designs small one-story residences or other

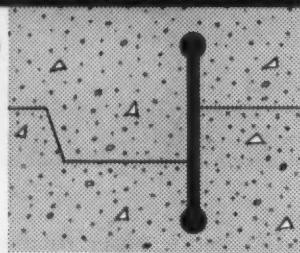
structures excepted under the Act and who does not hold an architectural, civil, or structural engineering license. It is presumed that the designer is not a registered civil engineer and he does not hold a certificate to practice architecture in California. It then follows that if the work matches the definition of civil engineering as given in Section 6731, it is civil engineering. If it does not, or if it is excepted from the Act under Section 6737.1, the Board is not interested.

However, if the work is civil engineering, it cannot be undertaken by anyone but a registered civil engineer (Section 6735). The designer cannot undertake any portion of the preparation of designs, plans and specifications, reports, or documents; nor can he declare that part of the work is civil engineering and part is something else. He is therefore in violation of Section 6787 (a), and the registered civil engineer cannot be legally engaged by the designer. If he enters into such an agreement with a designer, it is illegal, and he is guilty of aiding and abetting a violation and is subject to disciplinary action by the Board in accordance with Section 6775 (e).

Turn-Key Project Ruling

The second case presented to Flaherty by the association involved a licensed contractor who

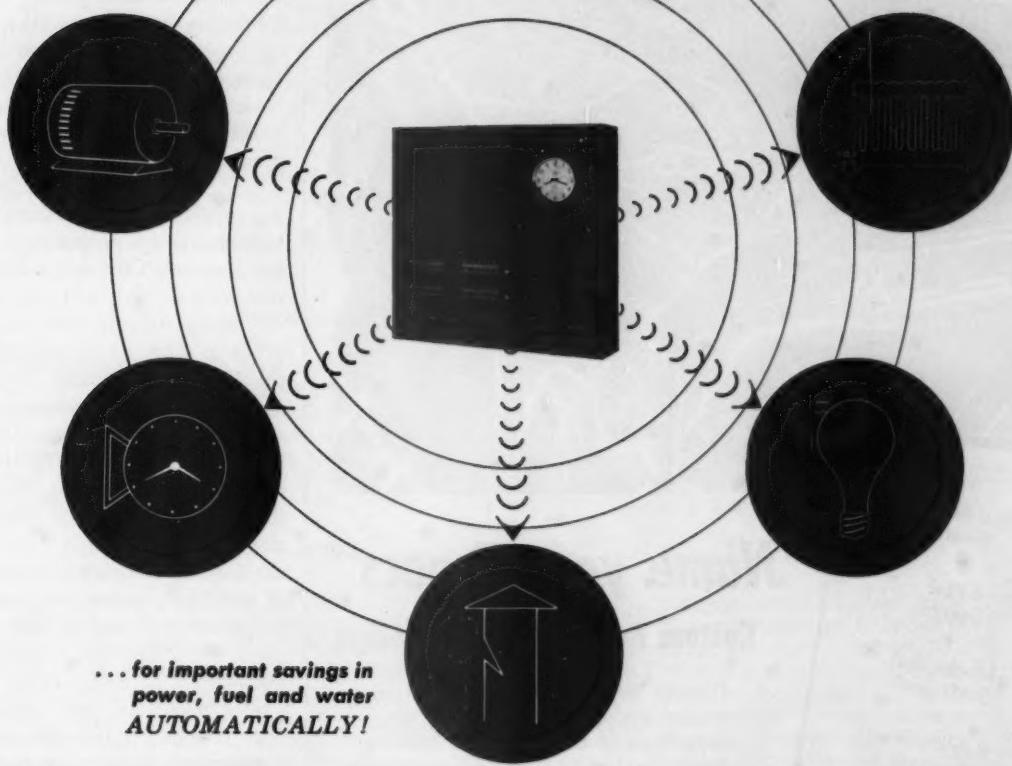
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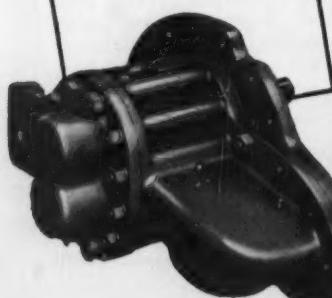
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offered to build a project in which civil engineering work was required. He did not have a civil engineering license himself. Has the law been violated by his offering to do a turn-key job, complete from zero plans to final completion? What if he has an employee who is a licensed civil engineer to do the engineering work and sign all such plans? What if he simply intends to secure proper engineering services after he obtains the contract? In fact, at no time does any civil engineer actually meet, talk to, or even get mentioned to the owner.

Under these conditions, according to Flaherty, it first must be determined if the project falls within the scope of civil engineering under Section 6731, and that it does not come within the exceptions given in Sections 6744 or 6745. Is the licensed contractor a partnership, firm, or corporation engaged in rendering civil engineering services which was lawfully in existence on September 30, 1947, and therefore exempt from the provisions of Section 6738 (d)? Or is the licensed contractor an individual who then cannot undertake the preparation of any portion of the plans, specifications, reports, or documents himself, unless he is also a registered civil engineer?

If the licensed contractor is a partnership, firm, or corporation, there must be a registered civil engineer who is either a member of the firm or a permanent employee of the partnership, firm, or corporation and is the person in responsible charge of the preparation of all civil engineering plans, specifications, and reports concerning the project. His signature or seal shall appear on all plans, specifications, and reports connected with the project. If these conditions are met, then the partnership, firm, or corporation can legally perform the civil engineering that is part of the turn-key job.

If the licensed contractor is an individual not registered as a civil

High-Purity Water Made Possible with Nalcite Ion Exchange Resins

Dresden Boiling Water Reactor System has Unusual Demineralization Needs

Water purity in a degree not even considered a few years ago is required at the Dresden Plant of Commonwealth Edison Company in Northern Illinois. Nalcite Ion Exchange Resins have been chosen for the condensate high flow, reactor cleanup, and waste treatment demineralization units, one of which has an unusual system for removal, regeneration and replacement of exchange resins.

Condensate High-Flow Demineralizer

2,800 gpm condensate, returning to the reactor from the turbine condenser, passes through the primary system demineralizer at flow rates of 70 gpm/sq. ft. of bed area. This demineralizer is designed to remove more than 1,000 lbs. of dissolved and suspended impurities from the condensate each year.

Resin Removed for Regeneration

To prevent cross-connections between the reactor and regeneration piping, equipment was developed for external regeneration of the ion exchange resins. This is accomplished by semi-fluid pressure transfer.

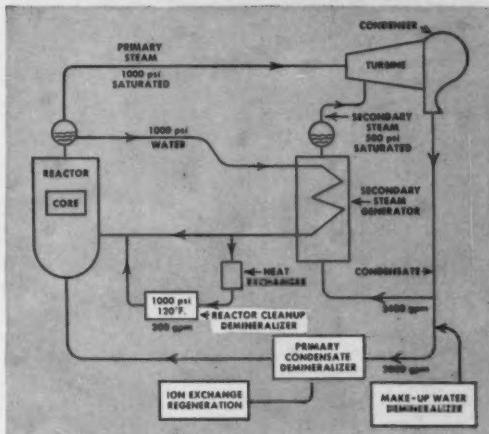
Nalcite HCR-W and SBR-P in the primary condensate demineralizer have the high degree of sphericity and ion exchange ability essential to high flow rate service at minimum pressure drop. They also have the resistance to attrition which permits resin transfer from the demineralizer to separate regeneration units and back, repeatedly . . . without measurable bead breakage.

Reactor Cleanup Demineralizer

The reactor cleanup demineralizer on the return side of the secondary steam generator system handles 200 gpm condensate at 1000 psi, 120° F. On-line and standby units have flow rates of 10 gpm/sq. ft. of bed area. Exhausted resins are radioactive, and are replaced with new resins, rather than regenerated.

Waste Treatment Demineralizer

Radioactivity in wastes is concentrated by the waste treatment demineralizer. Exhausted resins are radioactive and are sluiced from the units and prepared for disposal.



Simplified diagram of the Dresden Boiling Water Reactor steam condensate system. Nalcite resins are used in condensate high flow, reactor cleanup and waste treatment demineralizing units.

Make-Up Water Demineralized

Very small quantities of make-up water are required, due to painstaking design to eliminate condenser leakage, and other system losses. Conventional demineralizers, followed by mixed-bed polishers, provide make-up water.

Ideas for the Future

While operating temperatures and pressures at the Dresden Plant are nominal in modern steam generation practice, the special requirements for high flow and water purity from demineralizers in the steam-condensate system may have practical application outside nuclear reactor technology. It is significant that Nalco had ready, in Nalcite HCR-W and Nalcite SBR-P, ion exchangers which make possible these unusually severe ion exchange applications.

Ideas for Today

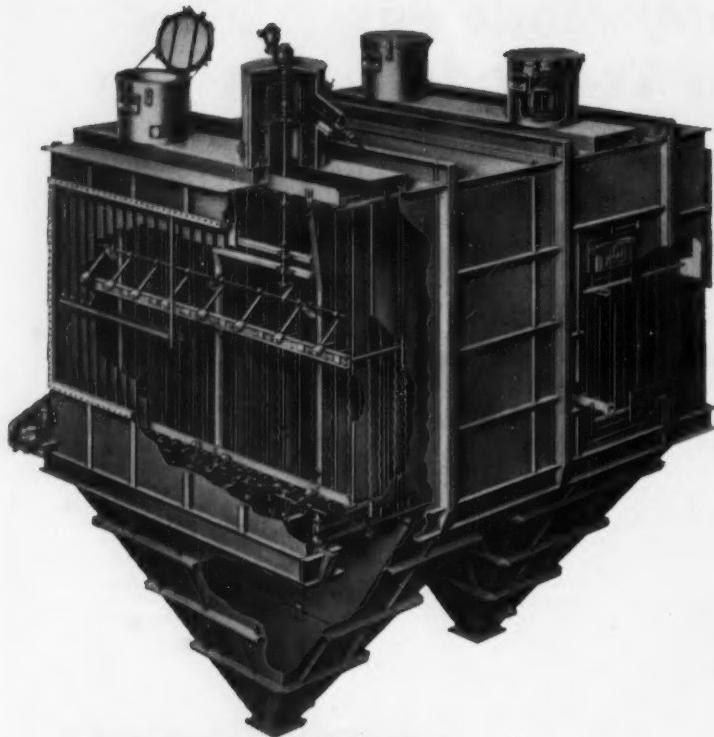
For busy engineers and technical men, Nalco has prepared concise data on water conditioning with Nalcite cation and anion ion exchange resins: Bulletins Z-12 and Z-13, free on request. If you want fast action on a specific water treating problem, Nalco experts are available on short notice. Call or write.

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EXPERTS AT DELIVERING EXTRA EFFICIENCY IN DUST RECOVERY SYSTEMS



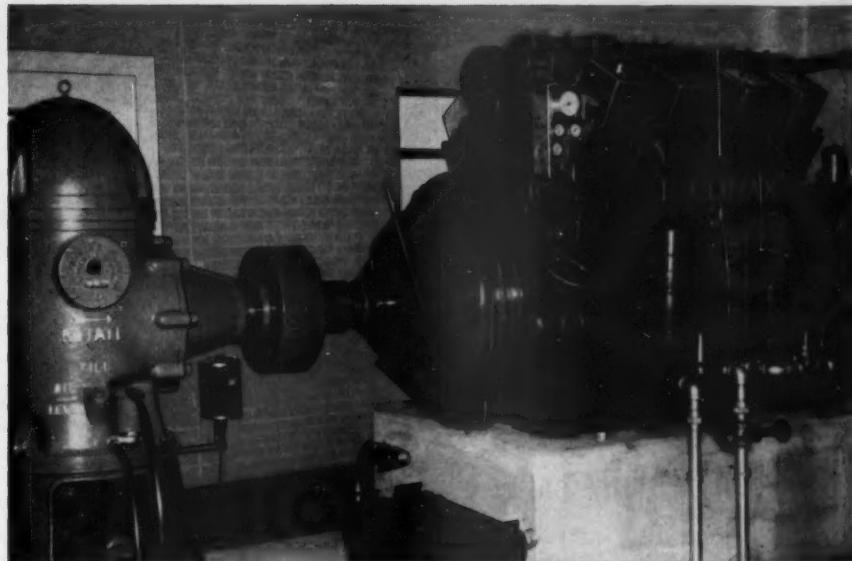
engineer, and he enters into a contract with an owner for a turn-key job, to be done completely on his responsibility, he is in fact undertaking to perform civil engineering in violation of the Act. In this instance, his employee, the registered civil engineer, is guilty of aiding and abetting a violation.

On the question, "What if he intends to secure proper engineering services only after he receives the contract?" it would be necessary to wait and see what transpired. An opinion rendered by the Attorney General of California, on June 4, 1953, covers the case where a licensed contractor, acting under a bona fide agency agreement with an owner, undertook to negotiate on behalf of the owner as his principal a contract with a registered civil engineer or architect to provide the necessary services.

This opinion held that an agency contract between an owner and an unlicensed architect, whereby the unlicensed architect agrees to negotiate on behalf of the owner as his principal a contract with a registered civil engineer or architect to prepare and furnish the necessary engineering services to the owner, violates no provisions of the law.

The opinion further held that there is no provision in Section 6731 that prevents or prohibits an individual, firm, company, association, or corporation engaged in any line of business other than the practice of civil engineering from employing a registered civil engineer for the conduct of their business. The design of residences of certain types by an unlicensed individual is not prohibited by the Act as stated in Section 6731 (e), and there would be no objection to the hiring of a civil engineer by an unlicensed architect to perform civil engineering services on such residences. However, it is not permissible for an unlicensed architect to hire a registered civil engineer to perform services where the unlicensed architect is designing an engineering structure. □

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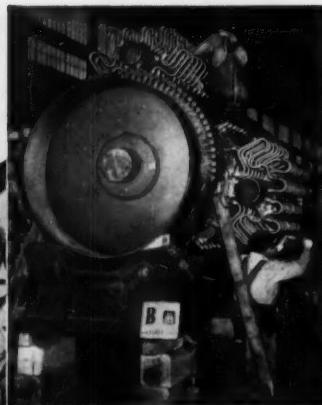
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CL-106

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R-165	6	6½ x 7	1238	930 @ 750	105	123	140	156	170	183	192	
K-67	6	7 x 7	1616	1240 @ 805	140	165	188	210	230	248	265	
K-75	6	7½ x 7	1855	1410 @ 800	160	186	214	240	265	286	304	
V-80	8	7 x 7	2155	1610 @ 850	178	210	241	272	300	323	340	
V-85	8	7½ x 7	2474	1860 @ 900	207	249	285	317	345	370	390	
V-122	12	7 x 7	3232	2440 @ 900	280	330	380	420	460	490	520	
V-125	12	7½ x 7	3711	2880 @ 850	310	370	435	490	540	580	605	

(1) Basic engine includes ignition, maximum carburetion, and water pump. Ratings indicate maximum horsepower.

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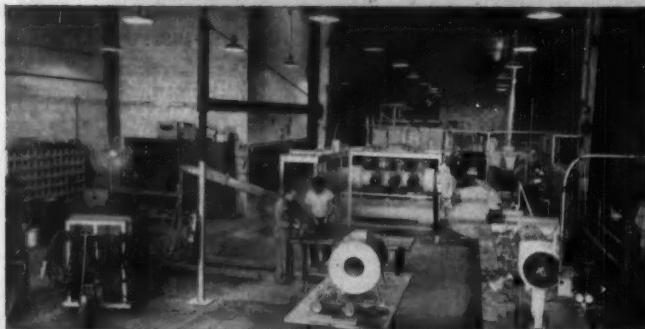
(Left) The huge riverside crane at Combustion's Chattanooga Division easily lifts this 92-ton stainless steel reactor vessel — the most complex reactor vessel built to date — into a barge for shipment to the Enrico Fermi Power Station, Lagoon Beach, Michigan.

(Right) Stainless steel sodium heat exchanger consisting of a series of tubes within tubes, encased in a pressure vessel.

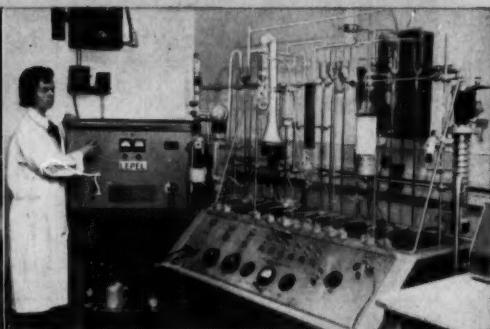
What C-E is doing to advance

The strange and wondrous world of the atom has been examined and surveyed by C-E scientists and engineers since 1946. The object—to put the controlled energy of the atom to productive use for the generation of power. The result—a wealth of knowledge and experience in the application, design and manufacture of nuclear power equipment. Backed by specially designed laboratories and manufacturing facilities, this knowledge and experience—greatly augmented and enriched by the acquisition of the General Nuclear Engineering Corporation early last year—has enabled C-E to undertake many kinds of nuclear work.

Notable C-E and General Nuclear projects are outlined on the opposite page. Virtually all of them are *current*, and many have a significant relationship to the vital task of making nuclear power competitive with conventional power. Collectively, these projects will contribute importantly to the Company's objective of achieving the same position of leadership in the atomic world of tomorrow which it has long since achieved in present-day methods of power generation.



Partial view of laboratory of General Nuclear Engineering Corporation at Dunedin, Florida, showing equipment used for the study of a high-pressure, high-temperature gas coolant system.



Portion of a laboratory at C-E's Nuclear Division, Windsor, Connecticut, showing gas analysis equipment used for detecting the presence of small quantities of gases in reactor materials.



The 520-foot-long Heavy Vessel Bay at C-E's Chattanooga Division was created especially for the manufacture of heavy nuclear components.

Portion of the 530-acre site occupied by C-E's Nuclear Division at Windsor, Connecticut. This Division is equipped for the development, design and test of reactor systems and the manufacture of reactor cores and core components.



Nuclear Power Progress

C-E NUCLEAR PROJECTS

For Electric Power Stations

- In association with Stone & Webster Engineering Corporation, a design study for AEC of an advanced type of large (236,000 kw) pressurized water reactor power plant.
- A long-term development program for AEC to determine the best means of using nuclear energy to generate superheated steam. (Success in this endeavor will be a big step forward in reducing the cost of nuclear-generated power.)
- Design studies for the Puerto Rico Water Resources Authority, under AEC contract, to determine the best means of adding nuclear superheat to a boiling water reactor.
- Design, research and development work covering a gas-cooled, heavy-water-moderated, pressure-tube type reactor for the East Central Nuclear Group, Inc., and the Florida West Coast Nuclear Group. This development will also lead to a nuclear power plant using superheated steam.
- The development and test of various kinds of fuel elements and fabricating procedures, under contract with the AEC.
- The design and manufacture of reactor vessels, including the largest and most complex vessels of their type built to date, for the Shippingport Station (America's first full-scale atomic power plant), the Enrico Fermi Atomic Power Plant, the Humboldt Bay Nuclear Power Station, and Italy's first nuclear power plant.

For Military Power Plants

- Design study for U. S. Army, under AEC contract, of a truly package type of nuclear reactor, using the boiling water con-

cept, for remote installations. This program includes operation of a prototype boiling water reactor at the National Reactor Testing Station in Arco, Idaho, and the training of military technicians in the operation of the installation.

- The conceptual design and operation of a nuclear test reactor, under AEC contract, to permit full-scale testing of prototype reactor cores for military field plants.

For Naval Power Plants

- The design and manufacture of a submarine reactor system designed to set new standards of accessibility, speed of startup and operational flexibility—and the operation of a land-based prototype installation.
- The design and manufacture of numerous reactor cores, reactor vessels, steam generators and pressurizers for various types of submarines and naval surface ships.

For Merchant Ship Propulsion

- The design and engineering study of a prototype pressurized water reactor for a 45,000-ton tanker, under contract with the AEC and the U. S. Maritime Commission.

Special Studies and Services

- Irradiation studies, fabrication studies, evaluation studies of the general properties of materials, quality control, isotopic analyses, strain gauge and photoelastic testing, basic and applied research in ferrous metallurgy.
- Bio-assays, decontamination, environmental monitoring, radiochemical analyses and radiological safety programs.

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No overhead tracks Substantial cost advantages

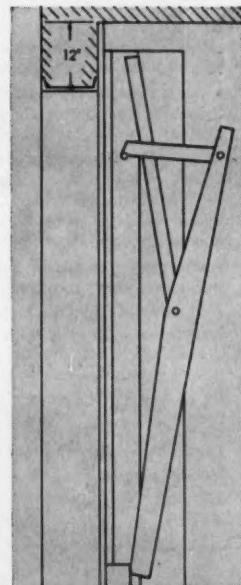
Here is the industrial door that provides proven design features never before offered in a product of this type.

The Byrnover Door travels at a rate of 120 feet per minute—approximately double the speed normally expected of turnover type doors. As a result, the actual opening and closing time is reduced to an absolute minimum.

This door employs an ingenious linkage system rather than overhead tracks. With this design necessary head room has been reduced to 12 inches and jamb requirements between adjacent doors

are as little as 12 inches. Another advantage is that crane runways can be extended to within 18 inches of the door opening.

And here are other points to consider. Byrnover Doors are built to sizes up to 32 feet wide by 22 feet high. All are of thoroughly weathertight construction. They incorporate a new, positive safety device which instantly reverses the downward direction of the door when it comes into contact with an obstruction while closing. Of major importance, they can be supplied at lower cost than any comparable turnover doors.



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Lee's Lecture

Program of the National Science Foundation

JOHN F. LEE

Broughton Professor and Head
Department of Mechanical Engineering
North Carolina State College

THE National Science Foundation was established in 1950 by Public Law 507 of the Eighty-First Congress. It is an independent agency of the Federal government concerned primarily with the support of basic research, training, and education in the sciences, and interchange and dissemination of scientific information. A 24-member National Science Board and the Director of the Foundation, all appointed by the President of the United States, develop the plans and policies of the Foundation and guide its operation.

Administration

Support of basic research programs is accomplished primarily through grants to investigators at colleges and universities and is administered through the Division of Mathematical, Physical, and Engineering Sciences; the Division of Biological and Medical Sciences; and the Office of Social Sciences. These groups also are concerned with the development of national policies for the support of fundamental research in their fields of interest. Programs in support of training and education in the sciences are provided under the direc-

tion of the Division of Scientific Personnel and Education.

The Foundation's Science Information Service functions to increase the availability to scientists and engineers of scientific literature in all languages. The service works to strengthen the entire system of communication, including indexing and abstracting services, information storage and searching techniques, information on foreign science, and publishing and dissemination methods. Research is supported to develop new techniques and methods, such as projects in mechanical translation.

The Foundation is making continuous fact-finding studies and analyses of scientific activities of the Federal government, industry, and the colleges, universities, and other nonprofit institutions. These studies are under the general direction of the Office of Special Studies, but the science divisions are directly responsible for planning and gathering information in their respective fields of interest.

The Office of Special International Programs is maintained by the Foundation to administer and coordinate government interest in special international programs,

such as those developed through United States participation in the International Geophysical Year and other similar programs.

Engineering Research

Support for basic research in the engineering sciences constitutes a major part of the activity of the National Science Foundation, and it is carried on within the scope of the Division of Mathematical, Physical, and Engineering Sciences. Dr. Kenneth G. Picha, on leave of absence from Georgia Institute of Technology where he is Professor of Mechanical Engineering, is Program Director.

Normally, proposals are originated by an individual research engineer and submitted by the institution with which he is affiliated. In order to be considered by the Foundation, such a proposal must carry the endorsement of the institution. An investigator not affiliated with an institution also may apply for and receive a grant.

Programs embrace the fields of chemical engineering, civil engineering, electrical engineering, engineering mechanics, mechanical engineering, and metallurgy. Each program is quite varied and is

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keyed to the requirements of the individual research engineer. Grants may provide for equipment, services, expendable supplies, graduate and undergraduate research assistants, salary of the principal investigator in certain circumstances, publication costs, travel expenses, and other costs directly related to the research project. Grants may cover a period up to five years. The unspent balance of a grant does not lapse at the close of the government fiscal year but remains to the credit of the grantee for the purpose and length of time for which the grant was made.

Evaluation of Proposals

All of the applications for basic research grants are evaluated by the Foundation's professional staff with the advice of their competent scientists who are specialists in the various fields of study. Review and evaluation of proposals normally take several months. Proposals recommended for grants are submitted to the National Science Board for approval, with the Director giving final approval in the initiation of a grant. Each year many more worthy projects have been submitted than the Foundation has had the funds to support.

A valuable byproduct of the research grant program is the training it affords research assistants under the guidance of experienced investigators. It also provides many young people with an opportunity to complete their formal training.

Specialized Facilities

Adequate large-scale facilities are essential to the conducting of some kinds of basic research. Phytotrons, telescopes, and electronic computers are among the types of major facilities for which scientists are finding increasing need but which are becoming increasingly hard to get as they become larger, more complex, more specialized, and as a result more costly. Educational institutions, with which most American basic research scientists



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are associated, find the cost of such facilities prohibitive. The Foundation therefore has undertaken to provide such facilities in instances where the need is urgent, where it is clearly in the national interest, and where necessary funds cannot be obtained from other sources.

Purchases cover specialized research equipment — equipment too costly to be included in support granted for a particular investigation but essential for the prosecu-

tion of a specific research project. It also must be susceptible to use on other research projects at the grantee institution which receives title to the equipment. Equipment of this nature includes items such as large electron microscopes, nuclear magnetic resonance apparatus, and some nuclear accelerators.

Two Types of Programs

The Mathematical, Physical, and Engineering Sciences Division has

two types of programs to promote acquisition of specialized facilities. The first consists of making grants to universities wishing to establish such facilities on their campuses. In most instances Foundation support is required to be supplemented by support from other sources, such as state governments or the universities themselves. This makes possible a wider spread of Foundation money and stimulates contributions from other sources for the benefit of basic research.

Current activities in the physical sciences for which the Foundation is granting partial support include establishment of university nuclear reactors for basic research purposes and regional electronic computer centers at universities throughout the United States.

The second major facilities program in the physical sciences consists of establishing government-owned facilities operated by research organizations on a contractual basis. They are used for the benefit of United States scientists and visiting scientists from abroad. The Foundation provides all funds for construction and operation of the facilities, and title remains with the government. The Kitt Peak National Observatory (for optical astronomy) near Tucson, Arizona, and the National Radio Astronomy Observatory at Green Bank, West Virginia, are government-owned, contractor-operated facilities of this nature.

During 1959 the Foundation received 309 proposals for research in the engineering sciences with a total dollar value of \$13,449,000. A total of 129 research grants were made in the same period amounting to a total of \$4.3 million.

Engineering Education

The Foundation is mindful of the need for a continuing supply of new engineering scientists and engineering teachers of excellent caliber. Ample opportunity also must exist for our present engineering scientists and engineering

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Haws Wall Mounted "Off the Floor" Water Coolers break with tradition to "clear the deck" for uncluttered maintenance ease. Crisp styling and the completely enclosed plumbing-electrical unit make this distinctive cooler a Haws "first"—in beauty and engineering!

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Wiring is in same conduit as clock and program system.



PRACTI-CALL system is incorporated
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... utilizes same conduit, existing bell
control board (background)
... is operated by office secretary.

Here at last is an *economical, sensible* communication system designed especially for schools. PRACTI-CALL fills *all* school communication needs:

1. General announcements, news, special events, emergency instructions, etc. are communicated to all classrooms simultaneously through an "all call" speaker system.
2. Conversations requiring privacy (approximately 90% of all intra-school communication) are carried on over a private telephone system.

With all its flexibility of use . . . an adaptability never before available . . . PRACTI-CALL costs substantially less. No bulky, high cost console . . . no intricate mechanisms to go awry.

IMPRESSIVE INSTALLATION SAVINGS—All basic wiring runs in the *same conduit* as the school's clock and program system . . . effecting additional important savings on installation.

PIN-POINTED RESPONSIBILITY—Service, whether on clock and program system or communication system, is from a *single source* when PRACTI-CALL is specified with a STANDARD program system.



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teachers to maintain their competence in the face of the rapid progress of research. To help find a solution to the problem thus raised — maintaining a high quality of scholarship in engineering — the Foundation's Division of Scientific Personnel and Education administers a wide variety of program activities in the general area of education in the sciences. For the most part these programs are directed toward helping young

scholars and recognized scientists further their scientific training, and helping science teachers increase their knowledge of the subject matter in their fields.

The Foundation awards fellowships to scientists, science teachers, and graduate students for programs of study or research designed to meet their individual needs. These fellowships are offered in the mathematical, physical, medical, biological, and engineering sci-

ences, and in anthropology, psychology (excluding clinical psychology), certain interdisciplinary fields, and selected social science fields. An applicant must be a United States citizen by the date on which the awards are made. He may file for only one type of fellowship in any one award period.

Fellowships

A fellow may carry on his scientific study or work only at accredited nonprofit institutions of higher education in the United States, or at nonprofit foreign institutions. Awards are granted on the basis of ability. Evaluation of applicants in each program is made by panels of scientists and engineers chosen especially for that purpose. Fellowships are awarded in the following categories:

¶ Graduate (Predoctoral) Fellowships (Annual Awards). These are available for students studying for master's or doctor's degrees. They are designed to provide support to unusually able students to allow them to complete their graduate studies with the least possible delay. Applicants are required to take examinations testing scientific aptitude and scholastic achievement.

¶ Cooperative Graduate Fellowships (Annual Awards). The Foundation has established this program to complement the graduate (predoctoral) fellowships program. An applicant for a cooperative graduate fellowship applies through the participating institution he expects to attend as a fellow. Initial screening and evaluation are accomplished by the institution's faculty, with final evaluation and selection by the Foundation.

¶ Summer Fellowships for Graduate Teaching Assistants (Annual Awards). These fellowships provide support to selected graduate teaching assistants of high ability to enable them to devote full time to their own scientific studies or research during summer months.

¶ Postdoctoral Fellowships (Semi-annual Awards). Fellowships of



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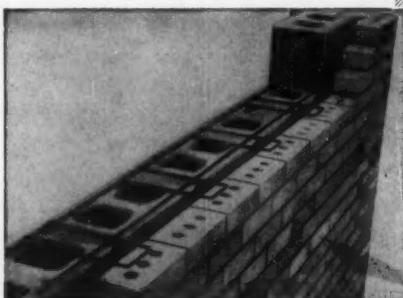
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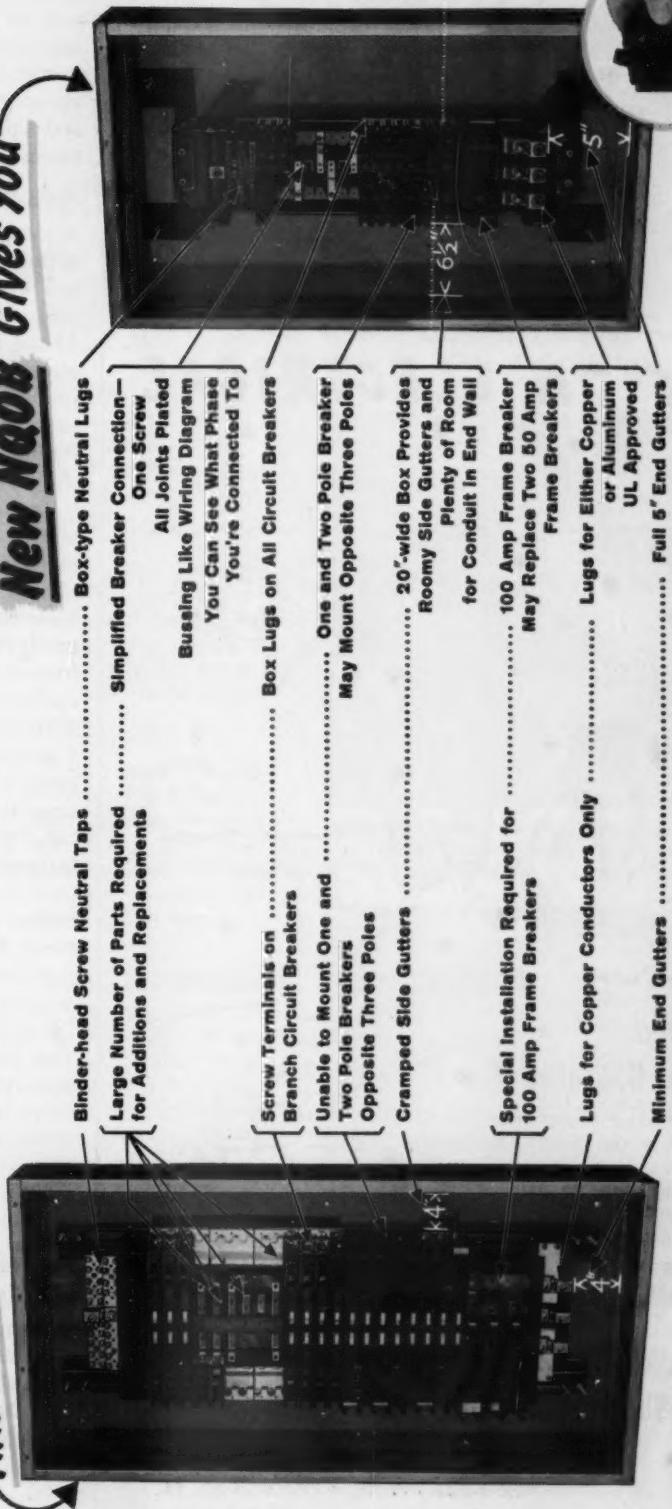
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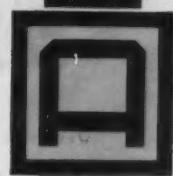
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this type are intended primarily for scientists and engineers who have recently received a doctor's degree, or have equivalent experience, and who need or are qualified for additional advanced training preparatory to specialized scientific work.

¶ Senior Postdoctoral Fellowships (Annual Awards). These fellowships are awarded to senior scientists and engineers of demonstrated ability who have had the

doctoral degree at least five years, or who have had equivalent scientific training and research experience. They are intended to permit additional study and/or research with a view toward increasing the fellow's competence in specialized fields of science or to broaden it in related scientific fields.

¶ Science Faculty Fellowships (Annual Awards). Awards in this category are intended primarily for the many college teachers of science,

mathematics, and engineering who wish further work or study with a view to enhancing their effectiveness as teachers. Applicants must have at least three years of college teaching experience, a baccalaureate degree, demonstrated ability, and special aptitude for science teaching and advanced training.

Special Projects

A sizable number of program activities for education in the sciences and engineering are concerned principally with the experimental testing and development of new ideas and new approaches to the problems of engineering science instruction, and with better methods for interesting our young people in studying science.

Curricula and courses in mathematics and the sciences have in many instances failed to keep abreast of the growth of scientific knowledge in recent years. To help modernize curricula, redirect courses, and provide stimulating and meaningful teaching aids, the Foundation has two programs:

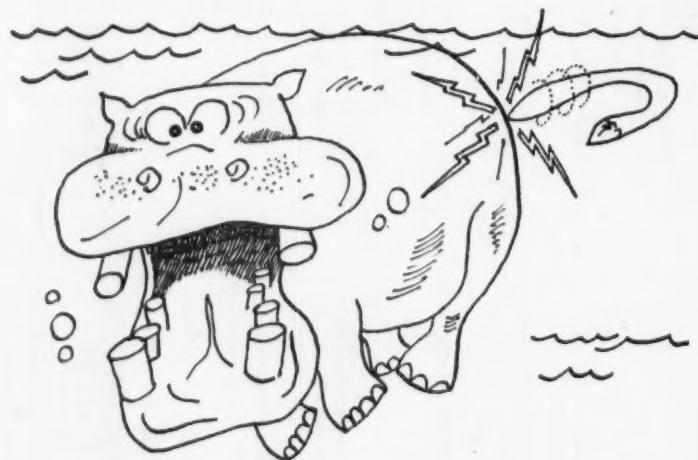
¶ Course Content Studies and Development. Support is given to projects involving leading scientists, mathematicians, engineers, and teachers in nationally significant undertakings to improve subject-matter content at various educational levels in the light of modern developments and of student needs in science and mathematics.

¶ Supplementary Teaching Aids. This program provides support for scientists, mathematicians, engineers, and teachers in efforts to develop new instructional devices, including films, television presentations, new laboratory equipment, and other teaching aids.

Further Information

Several booklets and brochures describing in detail all of the Foundation's programs are available on request. Letters should be sent to the Director, Dr. Alan T. Waterman, National Science Foundation, Washington 25, D.C.

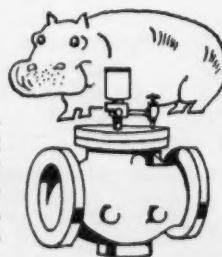
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How Commonwealth Edison Turned a Fly Ash Problem Into Profit

At Commonwealth Edison's State Line Station, about 350 tons of fly ash a day had to be wet down, loaded, and trucked to suitable dumping sites.

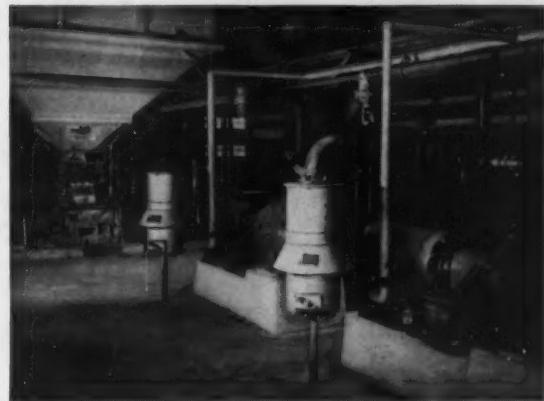
Waste becomes profit. Today, the plant burning a peak load of 5000 tons of coal daily collects dry fly ash automatically in a totally enclosed Fuller-Kinyon system. The ash is conveyed from precipitators to storage bins and silos, where it's sold as a by-product. Manpower: just three men, one at the main control panel and two bagging the ash.

Air and gravity do the work. F-H Airslide® conveyors fluidize dry fly ash by a column of low-pressure air for easy movement by gravity to central surge hoppers. Then, a Fuller-Kinyon pump under each hopper drives the ash by air through a five-inch line to storage. The system is practically maintenance-free. There are few moving parts to foul or wear out.

Large and small plants can get the benefits of Fuller-Kinyon fly ash handling. Capacities range from 100 to 8,000 cubic feet an hour. F-H Airslide and Fuller-Kinyon conveying lines can be curved to avoid beams and other obstacles. Low-pressure air provides power inexpensively and installation costs are significantly less than other types of conveying systems. Write for detailed information in Bulletin FF-49-1.



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BULK SILOS receive air-conveyed ash through Fuller-Kinyon pipe-lines. Farthest silo is 1,000 feet from pumps. Over 50% of fly ash is bagged and sold as a by-product.



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Welded Wire Fabric is now available with $\frac{1}{4}$ " diameter wires spaced as close as 2" on centers in both directions! These new areas of steel, plus the many time-tested advantages of Welded Wire Fabric, make it the ideal structural reinforcement for all types of construction—one-way slabs, two-way flat plates or flat slabs, walls, slabs on grade, etc.

Consider these advantages:

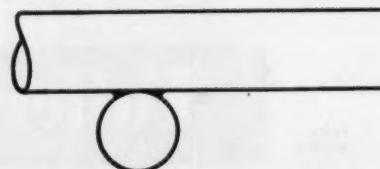
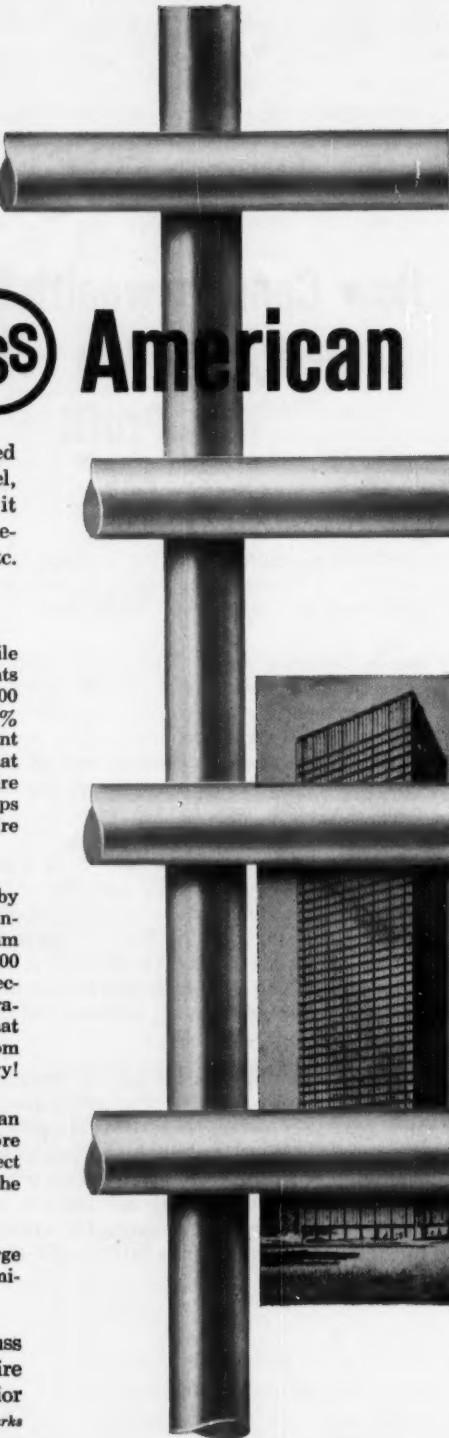
1. American Welded Wire Fabric is produced from cold-drawn high tensile steel wire. This wire is carefully produced to conform to the requirements of ASTM Specification A82-58T. The minimum tensile strength is 75,000 psi and the minimum yield point, as defined in this specification, is 80% of the tensile or 60,000 psi. Actually, cold-drawn steel wire has no yield point in the conventional sense—no sudden excessive elongation. This means that cold-drawn wire tends to resist stress practically throughout its entire strength range without revealing any sudden elongation such as develops in a typical hot-rolled bar. This physical advantage of cold-drawn wire makes it the ideal concrete reinforcement.
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3. American Welded Wire Fabric is prefabricated with greater accuracy than can normally be relied upon in field work. The wires may not vary more than $\frac{1}{4}$ " center-to-center than the specified spacing. This assures correct placement and distribution of the steel. Also, the wires are drawn to the very close tolerance of 0.003".
4. American Welded Wire Fabric requires very little on-the-job tying. Large prefabricated sheets are shipped to the job and placed as a unit. This eliminates thousands of ties and results in important labor savings.

The representatives of American Steel & Wire will be pleased to discuss with you the many advantages and applications of Welded Wire Fabric. Just contact American Steel & Wire, Dept. 0107, 614 Superior Ave., N.W., Cleveland 13, Ohio. *USS and American are registered trademarks*

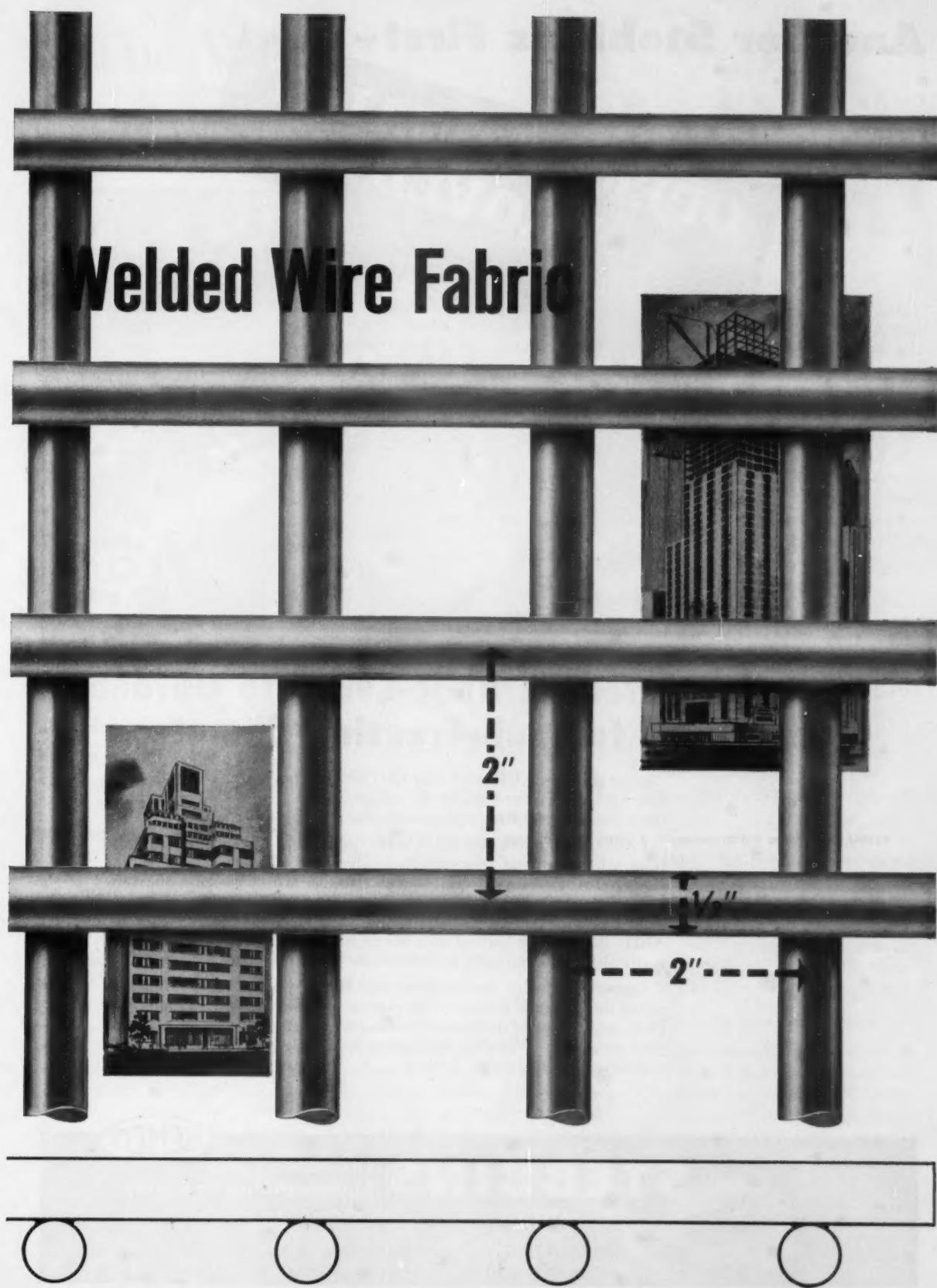


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Insulated Ceramic-Concrete Outdoor Tanks for Sub-Freezing Climates

The tank illustrated, located near the Canadian border, has been through two winters carrying stock at 4% consistency. With no addition of heat, there has been no freezing—no adherence to the inner walls.

Perfect for outdoor storage of acids, liquor and pulp slurries in locations where extreme temperature changes are commonplace, Stebbins insulated tanks conserve heat, decrease the hazard of freezing and provide more uniform liquor and stock temperatures for operations. Cost compares with that of insulated steel, wood stave and other materials, AND—the interior surface can be of tile or brick with proper joint material for full corrosion resistance.

Conserve valuable inside space and still prevent expensive maintenance due to stock freeze-ups. Specify a Stebbins insulated tank. Complete on your foundation ready for use, with concrete cover or open for your own cover. Wooden covers can be supplied by a Stebbins subcontractor. Write for full details.

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The Word From Washington

EDGAR A. POE
Consulting Engineer Correspondent



THE WORLD BANK started the New Year with a \$32.5 million loan for the further development of electric power in Chile. The larger part of the loan will help finance a 280,000-kw hydroelectric plant to serve Central Chile, where most of the country's industrial, commercial, and agricultural activity is located. The remainder will help finance a 15,000-kw thermal electric plant in Northern Chile. The loan was made to Empresa Nacional de Electricidad S.A. (Endesa) and Corporación de Fomento de la Producción (Fomento) as co-borrowers. The plant serving Central Chile will be located on the Rapel River, 75 miles southwest of Santiago. (For details of some of the other World Bank projects, see page 108.)

Cooperative Energy Development
A so-called common market in science and engineering designed to provide additional sources of energy for countries of the Western Hemisphere has been proposed. Dr. Jose A. Mora, Secretary General of the Organization of American States, advanced the idea at a meeting of nuclear energy specialists from the 21 American Republics at an Inter-American Nuclear Energy Commission meeting in Washington.

"Plans for development of the American countries," said Dr. Mora, "should not be limited merely to industrial and agricultural production, but to create sources of wealth and energy of all or a group of countries. In this connection, the use of nuclear

energy could offer one of the best prospects for a common or regional market . . ."

Wants AEC Work Limited

The United States Chamber of Commerce submitted to the Atomic Energy Commission 36 specific examples of industrial and commercial work which private industry is "ready and able" to take over from the AEC. The examples, assertedly an important part of AEC work, are grouped in eight fields including preparation of nuclear fuel; research and development; production of radioactive isotopes; irradiation service; reprocessing irradiated fuel; supplying depleted uranium; generating electricity; and the supply of various materials, services, and products.

Some members of the Joint Atomic Energy Committee of Congress like Senator Clinton P. Anderson of New Mexico, and Senator Albert Gore of Tennessee, are unlikely to approve turning over the work to private industry.

Engineers Needed

Federal Housing Administrator Norman P. Mason maintains that overall planning of the Nation's urban areas in place of a piecemeal pattern is most important for each locality. In the face of the tremendous urban growth lying ahead, Mason vows that only over-all planning by engineers can preserve the integrity of the communities, large and small.

To implement the new urban policy, Urban Renewal Commiss-

sioner David M. Walker issued procedures for putting the new authority into effect. Hereafter states applying for planning assistance for smaller towns and counties will be required to show that such planning will embrace the total urbanized area, including fringe areas and adjoining localities. Metropolitan, state, and regional proposals must encompass unified planning for the area involved rather than only portions.

Under the new policy set forth by Administrator Mason, engineers in their planning must embrace comprehensive land use studies to guide residential, commercial, and industrial expansion, plus projections of necessary public works including streets, throughways, schools, sewerage and water systems, and recreational facilities for the area's growing requirements.

During the next decade it is estimated that the urban population of this country will increase another 30 million. Demands for assistance in planning urban areas are already sizable and growing each month, according to the Housing and Home Finance Agency.

Utilities to Use More Coal

The electric utility industry, which draws most of its energy from coal, is expected to consume 190 million tons of coal in 1960, about 20 million more than in 1959, according to Commerce Department estimates. At the same time the growing demand for electric power assures an expanding demand for coal. The industry expects to pro-

HEINEMANN HAS A CURE FOR THE NUISANCE TRIPPING AILMENT



THE SYMPTOMS of panelboard sickness are easily recognizable. Breakers trip mysteriously. Service is interrupted without apparent reason. Yet there is no evidence of circuit faults.

THE CAUSE of the malady is, usually, ambient heat acting upon thermal-type protective devices. Such devices are designed to respond to the heat produced by load current. Trouble is, ambient heat gets added in with current-produced heat. Result: "artificial" overloading of the circuit . . . nuisance tripping.

THE CURE is obvious. Change over to circuit protectors that are not heat sensitive. Heinemann circuit breakers, for example. Heinemann breakers are magnetically actuated, have hydraulic time delay to allow for starting inrush or harmless transient overloads. They operate directly on load current, not the heat generated by that current. So: there's no heat effect on current-carrying capacity. No nuisance tripping. Just safe continuity of service . . . always.

FOR MORE INFORMATION, SEND FOR BULLETIN 3103

HEINEMANN
ELECTRIC COMPANY

127 Plum Street, Trenton 2, New Jersey



S.A. 1959

duce 436 million tons this year, substantially more than 1959 when the steel strike dropped the output to slightly over 400 million tons.

Construction Hits Record High

Despite the 116-day steel strike, a shortage in highway building funds, and difficulties in home financing, total new construction put in place in calendar 1959 reached a record high of \$54.3 billion, 11 percent above the \$48.9 billion for 1958. Private construction expenditures at \$38.3 billion represented a 14 percent gain. The Commerce Department said private residential building, increasing from \$18 billion in 1958 to \$22.4 billion in 1959, accounted for four-fifths of the over-all increase.

It also was a big year for construction materials. Stone, sand and gravel, clays, and cement gained from 10 to 15 percent, the Bureau of Mines reported. Cement production in 1959 was 9 percent higher than 1958 and 4 percent greater than the 1956 peak. Four new cement plants were built and numerous others expanded.

Power Production Compared

A Senate Subcommittee filed a report asserting that the United States is still far ahead of the Soviet Union in electric power production. Nevertheless, the Russians could overtake us in another 15 years "unless we speed up or they slow down."

The Subcommittee, which found that 80 percent of Soviet power is produced by thermal plants and 20 percent by hydro plants, spent a month inspecting Red power projects. The Subcommittee included Senators Frank E. Moss of Utah, Ernest Gruening of Alaska, and Edmund S. Muskie of Maine. A group of electric power experts accompanied them.

Atomic power is not expected to supply significant amounts of power in either the Soviet Union or the United States during the next few years, the report said.



This \$5,000,000 fire might have been prevented with a steel pipe automatic sprinkler system

There wasn't much left when this \$5,000,000 industrial property in New England burned to the ground. Yet how different the ending could have been if a *steel pipe* fire sprinkler system had been installed and the fire checked at its inception.

Yes, it pays to have an automatic sprinkler system in any building—store or warehouse, hospital or hotel, theater or school. As to cost—insurance premium savings often more than pay for the fire protection system's installation.

Backbone, of course, of fire sprinkler systems is dependable *steel pipe*. Architects, engineers and contractors know that low-cost, easily-worked *steel pipe* provides lasting and dependable service. That's why *steel pipe* is first choice for fire sprinkler systems, electrical conduit, vent and drainage lines, structural applications, radiant heating, snow melting, refrigeration, ice making and gas, air and water transmission lines.

STEEL PIPE IS FIRST CHOICE

- Low cost with durability
- Strength unexcelled for safety
- Formable—bends readily
- Weldable—easily, strongly
- Threads smoothly, cleanly
- Sound joints, welded or coupled
- Grades, finishes for all purposes
- Available everywhere from stock

INSIST ON PIPE MADE IN U.S.A.

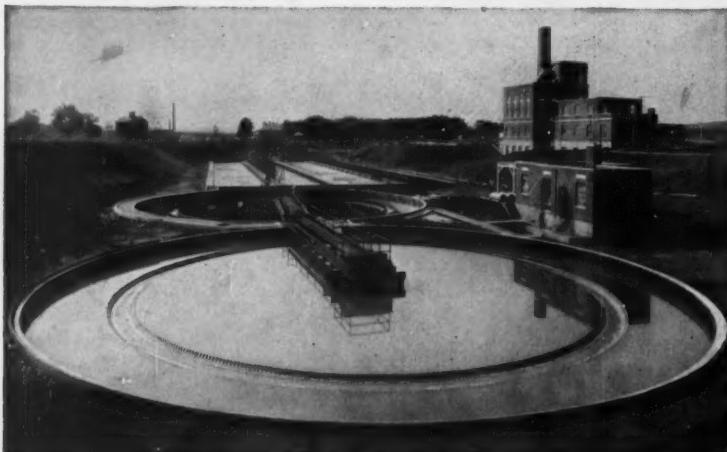


Automatic sprinkler systems check fires at their start—quickly, automatically and economically.

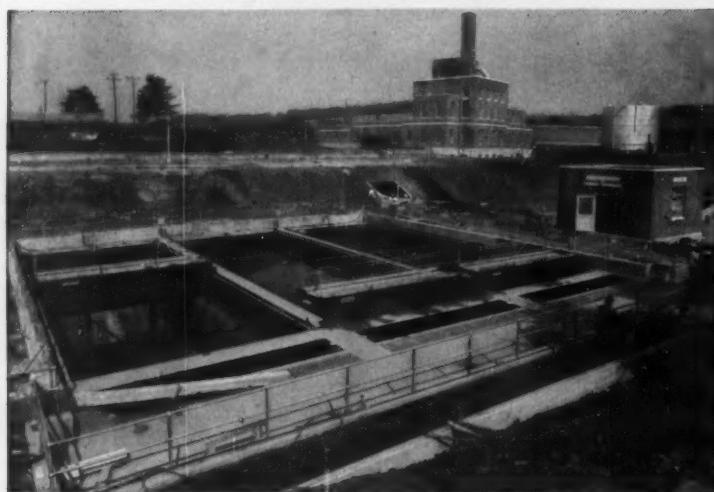
COMMITTEE ON STEEL PIPE RESEARCH

150 East Forty-Second Street, New York 17, N.Y.

Hardinge CLARIFIERS



for circular tanks



for rectangular tanks

Hardinge Circular Clarifiers and Thickeners are being used in:

- SEWAGE TREATMENT PLANTS for primary and final clarification and sludge thickening.
- INDUSTRIAL WASTE TREATMENT of all types.
- WATER TREATMENT, industrial and public.

Hardinge has also installed more than 70 rectangular clarifier units for municipal sewage treatment, oil refinery wastes and miscellaneous industrial liquid wastes — processing in excess of 300 million gallons of liquid daily.

Detailed specifications for all types and sizes are available upon request. Bulletin 35-D-64.

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Atomic energy has been and will continue to be a great challenge to scientists and engineers.

Mutual Benefits

Commissioner Ellis L. Armstrong of the Bureau of Public Roads said the vastly expanded highway program has resulted in many multipurpose projects. As an example, he cited a North Adams, Massachusetts, project involving work with the Army Engineers and the Federal Housing and Home Finance Agency in an effort to combine flood control, highway improvement, and urban renewal. In Utah, a highway embankment has been combined with a dam, providing flood control and irrigation storage features in addition to the highway improvement.

New Trend in Low-Rent Housing

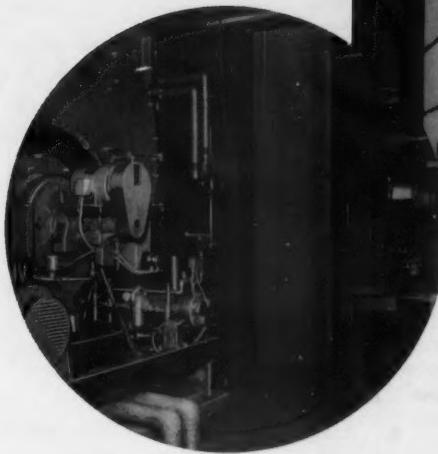
A survey by the National Association of Housing and Redevelopment authorities shows an acceleration of the scattering of public low-rent housing units in small groups or singly. In past years they have been confined to large apartment blocks. About 90 municipalities have scattered-site projects in the planning, clearance, or construction stage. A total of 17,000 housing units are involved. They vary from single-family homes and duplexes that fit into the pattern of the neighborhood to so-called vest pocket apartment buildings.

Aid for Surveyors

Bureau of Land Management's astronomical almanac, issued annually for use by its cadastral engineers, is off the press. Entitled "The Ephemeris, 1960," the booklet contains tables and charts of the daily position of the sun, and hourly changes in declinations, upper culminations, and elongations of Polaris (the North Star). Semi-monthly positions of 28 other selected stars also are given.

It is the only official publication of its kind designed for the use of cadastral engineers rather than as-

Where the steam comes from



...for Mutual Benefit Life's
fine new buildings in Newark, N. J.

Complete firing system in one package. Every factor that affects firing efficiency is engineered into the unit at the factory. The unit includes: (1) Single or dual-fuel burner, with complete fuel handling systems. (2) Forced draft air supply. (3) Enclosed control panel, with instruments mounted, factory wired and tested, and with signal lights and gauges that afford a complete reading at a glance. In the oil-gas units, fuels can be switched automatically, or with the simple flick of a switch.

Fire low cost residual oils

The heavy residual fuel oils (No. 5 and 6) have higher heat value than light heating oils, yet cost less per gallon.

The Iron Fireman boiler-burner units shown here fire these sluggish oils with complete dependability. They protect against fuel emergencies because they can fire *any* grade of oil, light or heavy.

Gas or oil—switch fuels instantly

Dual-fuel models fire either gas or oil, and can be switched either by manual or auto-

matic controls. In some areas gas rates are substantially less for customers whose steam plants switch automatically from gas to oil firing when outdoor temperature falls below a certain level, relieving the load on main gas lines when demand is highest.

Fires all types of boilers

Iron Fireman residual oil firing (with or without gas) is available in complete boiler-burner units ready for service connections, or as a package firing system that can be applied to any type of boiler.

Send coupon for further information

IRON FIREMAN®

AUTOMATIC FIRING EQUIPMENT
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Please send information on Iron Fireman forced draft firing for oil, gas or oil-gas combination.

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Address.....

City..... State.....



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Easy to read as a clock. A Liquidometer Gauge indicates the exact level at all times... shows it at a glance. And gauge operation is completely automatic—as far as 250 feet from the tank—without need for auxiliary power of any kind.

A Liquidometer Tank Gauge measures virtually any liquid. It's simple to install—requires no maintenance. Many have provided over 30 years of efficient, dependable service. All are approved by Underwriters' Laboratories and Factory Mutual.

Whether your gauging needs require an automatic Liquidometer Gauge, a hydrostatic Levelometer or a tank-site-indicating Direct Reader, you'll get the best by specifying Liquidometer. For complete details write Dept. C.

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tronomers. It provides the necessary basic data for field astronomical determinations required in present day surveying practices.

Auto Travel Patterns Unchanged

The Bureau of Public Roads says its research shows that the average motor vehicle traveled 9658 miles in 1958, nearly half of it in cities, and consumed 776 gallons of fuel at a rate of 12.44 miles per gallon. The average passenger car traveled 9494 miles in 1958. Of the 1958 travel, 40 percent was on main rural roads, comprising 14 percent of the nation's 3,500,000 miles of roads and streets. Another 46 percent was on urban streets, which comprise only 11 percent of the total mileage. The changes from 1957 were regarded as insignificant.

1959 Disappointing to ARBA

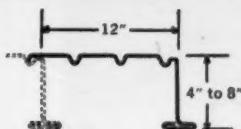
Although 1959 was a record-smashing highway construction year, the American Road Builders' Association insists that the year was a disappointment relative to new construction contract awards. A total of \$11.5 billion was apportioned by the Federal government for highway matching funds for the fiscal years of 1957-60, compared with a total of \$9.5 billion for all the preceding 40 years.

Problem of Planners

A significant trend is taking place in the Nation's growing population. People are marrying younger all the time. This shift is of marked importance to future planning operations in various fields of endeavor of interest to consultants.

The average age for marriage has shrunk substantially since 1945. Forty-eight percent of all women married in 1959 were 20 years old or younger. The current median age for marriage by men is 22 years as compared with 24 years some 20 years ago, and 26 years at the turn of the century. Some economists are predicting that during the 1960s about half of the marriages will involve teenagers.

New roof systems for schools...by INLAND



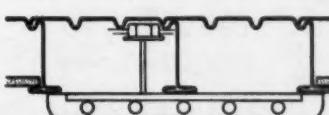
T-STEEL — New! Galvanized. For clear spans to 32'0". Adaptable to acoustical and flush, luminous ceiling treatments. Provides superior diaphragm to transmit seismic and wind loads.

Ceiling Treatments with T-Steel Deck

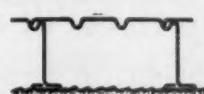


Standard Tile or Board

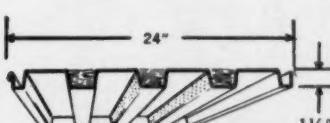
Light Diffuser



Surface-Mounted Fixture

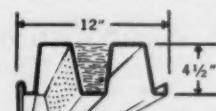


Lath-and-Plaster Fireproofing



TYPE B ACOUSTIDECK — For purflin spacings from 6' to 10'. Uses minimum of 1" rigid insulation board.

EP-2A



TYPE C ACOUSTIDECK — For purflin spacings from 10' to 20'. Uses minimum of 1 1/2" rigid insulation board.

Complete structural systems that broaden your latitude in planning ceilings, lighting, acoustics —within realistic budget boundaries

1. Acoustideck for gymnasiums, other activity areas

Combines steel roof deck and acoustical ceiling with Noise Reduction Coefficient of .70.

Erected fast in any weather that a man can work. Interesting ribbed underside provides an attractive ceiling surface.

2. New Inland T-Steel Roof Deck for clear-ceiling classrooms

Especially suitable over classrooms of 26' to 32' spans —or other areas where you want an attractive unbroken ceiling surface.

You can use various types of acoustical tile — provide a flush, luminous ceiling — or leave the underside exposed and painted.

Write for catalogs 240, 241, and 246 or see Sweet's, sections 2c/Inl and 11a/In. Inland Steel Products Company has trained sales engineers capable of giving you the benefit of their diversified experience on specific problems. Write or call your nearest Inland office.

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WHO ELSE MAKES THIS MANY TYPES OF CIRCUIT BREAKERS?



TRI-PAC[†]
current-limiting breaker for 100,000-amp faults



THERMAL-MAGNETIC
the industry standard

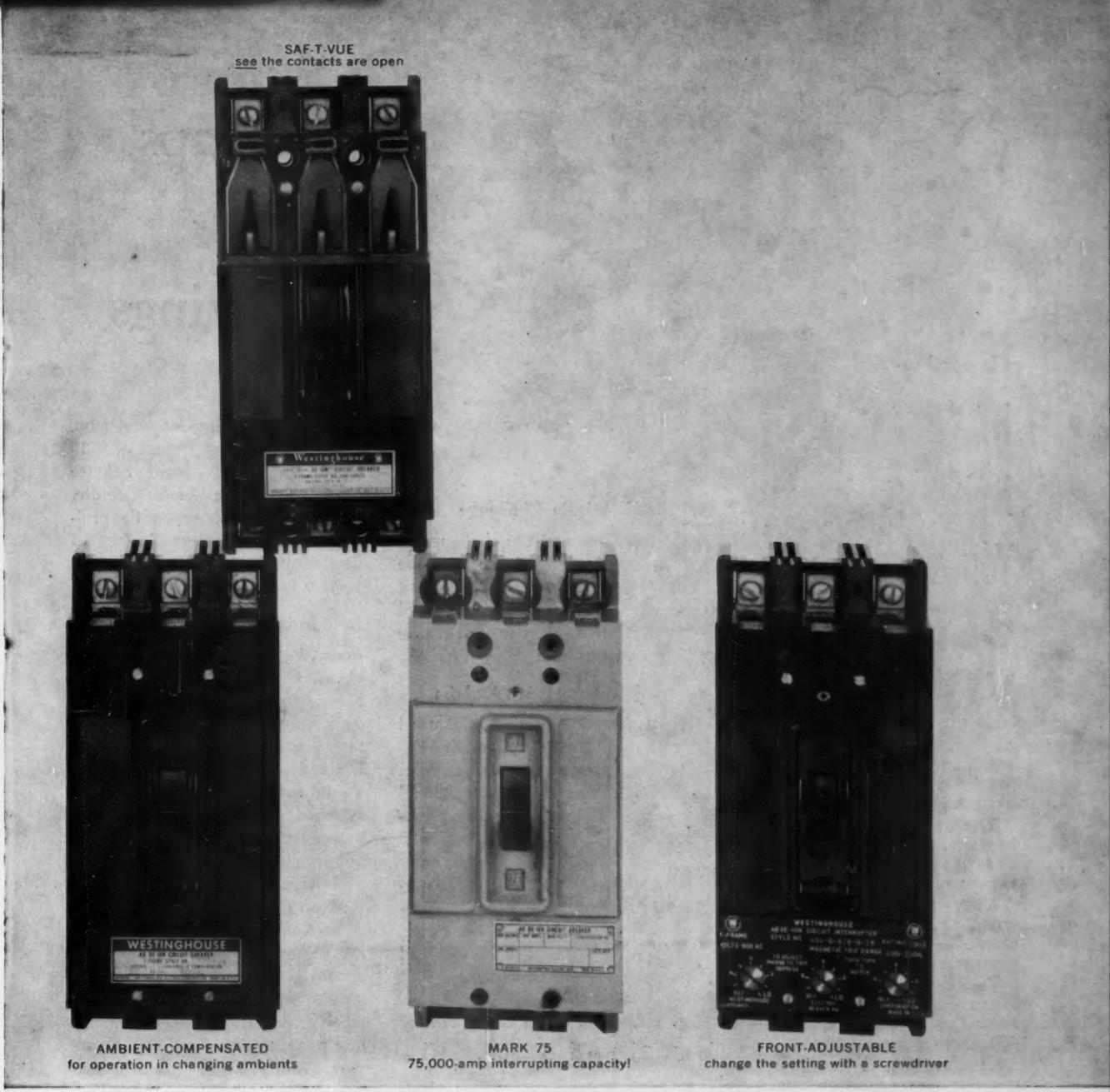
NOBODY BUT WESTINGHOUSE! It's true! Only Westinghouse offers you six complete lines* of circuit breakers—to solve six different kinds of circuit protection problems.

Here's what that means to you: You don't have to accept any "cure-all" type of breaker for your special applications. You can get the right breaker—designed by Westinghouse to do just that special job.

And these aren't high-priced "special" breakers. They're Westinghouse

*Three of these breaker lines are Westinghouse exclusives!—(Saf-T-Vue,[†] Ambient-Compensated, MARK 75!)

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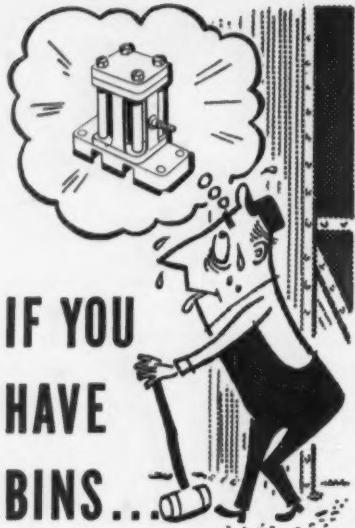
standards—available now in most any frame size, rating or interrupting capacity—in literally thousands of combinations.

We suggest that next time you've got a problem involving circuit protection, call on Westinghouse. Chances are the answer is already in our warehouse. For further information on industry's only complete line of circuit breakers, please contact Standard Control Division, Westinghouse Electric Corporation, Beaver, Pa. Or call your nearby Westinghouse sales office.

J-30263

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BINS...
You should have
CLEVELAND
VIBRATORS**

Anyone who stores materials in bins will find a vibrator an economic necessity. Bin vibrators completely overcome plugging and jamming.

The only substitute is a sledge hammer. This involves first, valuable man hours and secondly, expensive bin damage.

A bin vibrator will eliminate these costs. As a result, they will pay for themselves in a very short period of time, actually a matter of weeks.

The Cleveland Vibrator Company offers you complete engineering service on both air and electrically operated vibrators.

If you use bins, chutes, or hoppers you can save valuable dollars, by writing today for complete information and prices on Cleveland Bin Vibrators.



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Scraps & Shavings

sponsorship of The Cooper Union, which has received a grant of \$43,410 from the National Science Foundation (see Lee's Lecture, page 145). Co-sponsors of the project are the American Society of Civil Engineers and the American Society for Engineering Education.

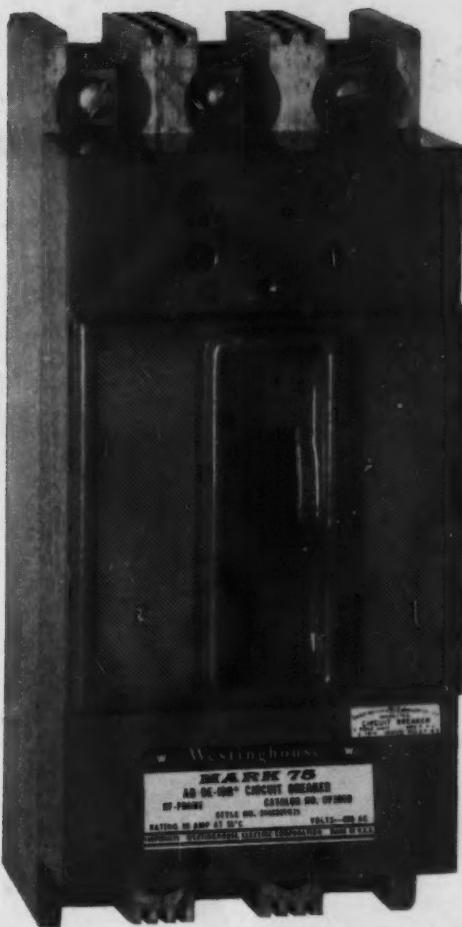
California's Transit Problems

According to Executive Director C. M. Gillies of the Los Angeles Metropolitan Transit Authority, consulting engineers are studying the various rapid transit proposals whose costs range from \$2 million a mile to \$20 million for an initial system of 40 to 45 miles. To avert a chaotic transportation situation, long range expenditures may reach \$1 billion.

Meanwhile, in San Francisco, directors of the Golden Gate Bridge and Highway District unanimously approved a proposal for a new engineering survey to determine whether the span also could handle fast train service. Cost of the survey, about \$25,000, will be borne by the Bay Area Rapid Transit District, which sought the study. The bridge directors agreed to permit the district to select one of three top suspension bridge engineering firms to begin the study. The firms are D. B. Steinman and Ammann and Whitney, both of New York, and Modjeski and Masters, of Harrisburg, Pennsylvania.

Phoenix to Use Consultants

Because of delays resulting from litigation over the use of antici-



INTERRUPTS 75,000 AMPS MARK 75 CIRCUIT BREAKER

High interrupting capacity
in standard frame sizes

- Mark 75* breaker is ideal for use in network systems.
- Mark 75 breaker is UL approved.
- Mark 75 breaker is available at only a fraction of the cost of other high interrupting capacity breakers . . . and comes in the same sizes and is interchangeable with the standard line of Westinghouse AB breakers.
- Mark 75 breaker is available now in frame sizes HF, HK, HKL and HLM. Only from Westinghouse can you get the right breaker for every application.

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*Trade-Mark

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Planner, Developer and Leader of the Circuit Breaker Industry

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Send Today for this New Data on Upward-Acting Doors for Every Need



Kinnear originated the interlocking slat door

Get full details on this complete line of time-saving, cost-slashing doors. They add highest efficiency to space-saving, coiling upward action. Kinnear offers a wide choice of flat and curved slats—fabricated of aluminum, zinc-coated steel, or other metals. They fit every need, from small counter openings to largest doorways. Slat sizes range up to the seven-inch "Goliath" slat at the extreme left, above—maximum protection against wind,

weather, intrusion or vandalism!

Zinc-Coated Dual Protection
Kinnear Steel Rolling Doors feature extra-heavy hot dip galvanizing! 1 1/4-ounces of pure zinc per square foot of metal (in accordance with ASTM standards). And Kinnear's special phosphate treatment makes this zinc surface ready *immediately* for thorough paint grip.

Make sure you get this complete door guide—check it now!

KINNEAR
ROLLING DOORS
Saving Ways in Doorways

The KINNEAR Mfg. Co.
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pated state gasoline tax refunds to pay off street bonds, Phoenix' plans for a city street improvement program have been seriously delayed. As a result, the city engineer's office lacks an adequate staff to carry out the program, now that the State Supreme Court has ruled favorably. Private engineering firms will be called in to eliminate the bottleneck so that construction can get underway as soon as possible.

Government Engineering for India

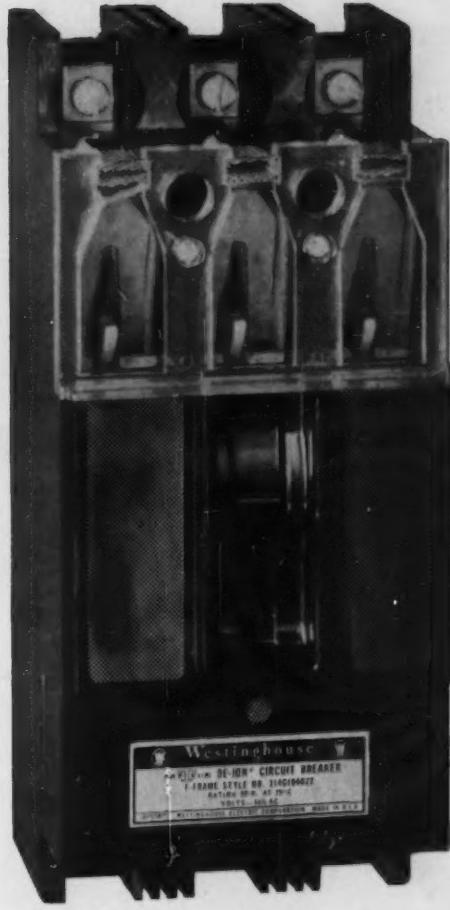
The government of India is setting up a consultant group, the Central Designs Organization, for the design and scheduling of future steel plants. A nucleus already has been created with a Chief Design Engineer and 30 young engineers, all Indians, now functioning. Their offices are at Rourkela, site of the huge steel plant installed with West German technical and financial assistance. A comparative study of three steel plants is under way, Rourkela, Bhilai (USSR assistance), and Durgapur (UK assistance). A further expansion of these three steel works is presently being considered.

The High Cost of Coffee

For employees earning \$5000 per year, the coffee break costs 4¢ per minute. At the going price of 12¢ per cup in downtown Chicago, the employer is paying about five times the price of the coffee for a typical 15-minute break. When earnings jump to \$15,000 per year, the cost per minute rises to 13¢. All of which simply backs up the practice of many offices where coffee is served on the premises, at no charge to the employee.

Co-op Engineers Get Jobs

Last year's engineering graduates from the University of Detroit were 88 percent employed as of graduation day, primarily because many of them took permanent employment with companies that had been hiring them on a co-operative earn-and-learn program. Graduates in



CONTACTS ARE VISIBLE! SAF-T-VUE CIRCUIT BREAKER

You can see the
contacts at a glance

- Saf-T-Vue* offers breaker convenience with maximum safety.
- Saf-T-Vue is suitable for use where plant safety codes require visible contacts.
- Saf-T-Vue is available in frame sizes E, EH, F, G, J, JK, K, JKL, KL and LM. Only from Westinghouse can you get the right breaker for every application.

For complete information on this new Westinghouse development, contact your nearby Westinghouse sales office or distributor, or write Westinghouse Electric Corporation, Standard Control Division, Beaver, Pennsylvania. J-30308

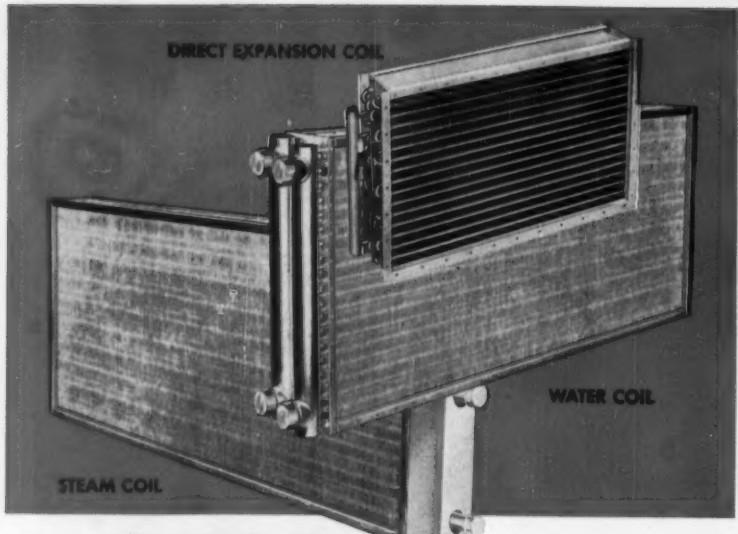
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CHOOSE BOHN KNOWN-CAPACITY COILS

ALL BOHN COILS are ruggedly built...

- Die-formed plate-type aluminum fins... from 4 to 14 per inch... with self-spacing collars completely covering the tubes. Permanent, tight, metal-to-metal fin-tube bond.
- Heavy-gauge casings die-formed from galvanized steel.
- Headers of heavy-wall seamless copper tube with heavy die-formed end caps. High pressure tested at 320 psig. minimum air pressure under warm water.
- Tested and rated according to ASRE-ASHAE standard 33-58.

IN ADDITION ...

DIRECT EXPANSION COIL — Type DE, insures equal distribution of refrigerant with brass pressure-type distributors;

WATER COIL — in Types WH, WF, and WD, is drainable in every type;

STEAM COIL — in Types S, NFS, and NFO, has condensing tubes pitched in casing a minimum of $\frac{1}{8}$ " per foot of tube length, as well as orificed steam supply tubes, and coil tubes floating free within coil casing to prevent stress and strain on tubes and joints... maximum operating pressure 200 psig. at 400° F.

A Memo from BOHN:

We are one of the largest manufacturers of specially designed evaporators and condensers for Original Equipment Manufacturers of refrigeration and air conditioning units and systems.

For full information, call or write ...

BOHN *Buy the known line...the BOHN line*
Aluminum & Brass Corporation

Danville Division • Danville, Illinois

commerce were at 47 percent, and those in the arts and sciences at 55. The engineers started at an average of \$524 per month, almost \$100 more than the average of other graduates.

Soviets Claim Super Metal

Russian scientists claim to have discovered a process for treating an undisclosed metal to give it a tensile strength of almost 200,000 psi. It is theorized that the process pushes the atoms of metal closer together to create a continuous chain of great structural strength.

Ohio River Pollution

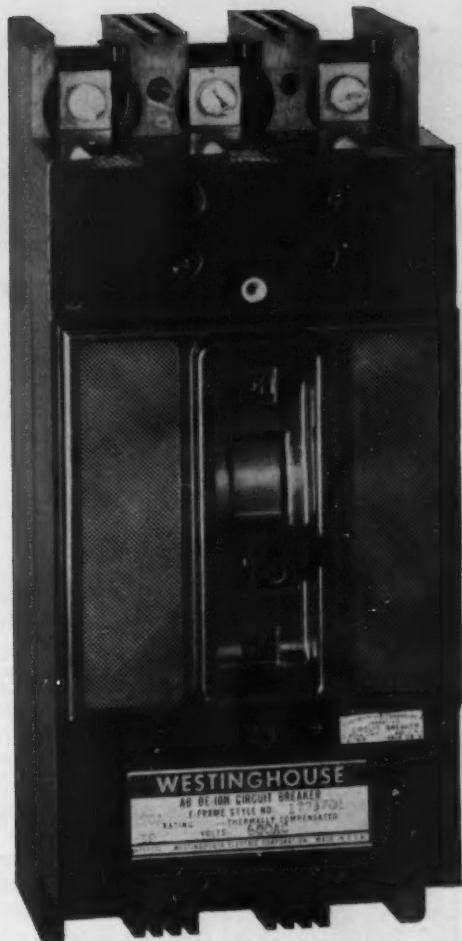
According to Chairman Maurice E. Gosnell of the Ohio River Valley Water Sanitation Commission, sewage purification facilities either are in operation or nearing completion for 95 percent of the population along the Ohio River. Highlight of the program was the completion of Pittsburgh's \$100 million plant.

However, conditions on the upper Ohio and some of its tributaries remain poor. Oil pollution and industrial effluents are not under control, particularly acid discharges from coal mining operations. There are also a few communities which are laggard in meeting their obligations. Among these are Ambridge, Pennsylvania; Huntington, West Virginia; Maysville, Kentucky; Martins Ferry and Bellair, Ohio; and Cairo, Illinois.

Earthquake Engineering

An earthquake strain gauge for multistory buildings has been designed by the Committee of Strain Gauges of the Earthquake Engineering Research Institute. It is hoped that engineers, architects, and building owners will cooperate in the installation of these gauges to contribute data necessary for the development of structural design.

Meanwhile, the Structural Engineers Association of California has published "Recommended Lateral Force Requirements" as a result of work done by its Seismology Com-



PREVENTS NUISANCE TRIPPING AMBIENT-COMPENSATING BREAKER

No worry where extreme
temperature changes exist

- Ambient compensation prevents the breaker from derating the conductors.
- Ambient compensation provides insurance against current interrupting due to false high-temperature influences.
- Ambient-compensating breakers, exclusive with Westinghouse, are available in all frame sizes. Only from Westinghouse can you get the right breaker for every application.

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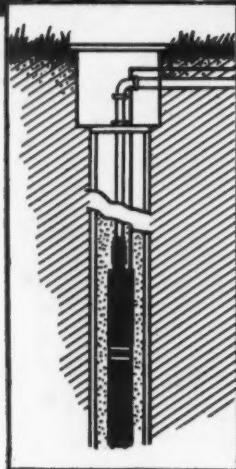
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Picture of a 2000 gpm SUMO Submersible water pump installation!



Yes! That's the beauty of a Sumo Submersible. No pump house or other protection is needed to safeguard the motor against freezing, dampness or tampering. The Sumo Submersible operates completely inside the well — pump and motor both — under water.

The idea is not new. It's not radical. It's just plain commonsense engineering as Sumo has proved after almost 50 years of specializing in the submersible pump field. The motor is coupled directly to the pump and forms a complete, compact unit that makes more efficient use of power . . . provides a neater, simpler installation . . . and assures long, troublefree operation.

Sumo Submersible Pumps come in a full range of sizes up to 125 hp with capacities to 3300 gpm. Consider their use for any deep well requirement whether it be commercial, industrial or municipal. They'll quickly pay for themselves.

Write for information. Ask for literature on Sumo high-capacity pumps. For specific recommendations, state your water requirements and the depth of the well. Engineering assistance is always available without obligation.



SUMO SUBMERSIBLE DRAINER PUMPS

For pumping water containing up to 20% solids. Ideal for dewatering or flooding or use in areas where internal combustion engine driven pumps present a hazard. Capacities up to 400 gpm. Write for literature.



SUMO PUMPS INC.

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Warehouse Stocks: Stamford • Dallas • San Francisco
The Complete Line from $\frac{1}{2}$ hp to 125 hp

mittee. The new bulletin is the result of long and intensive research and study.

Openings for Engineers

According to a mid-January check with the Engineering Societies Personnel Service Inc., the demand for engineers in 1960 will be the same as for 1959 — with the possibility of some increase. Approximately 3000 positions were available in both 1958 and '59, although there were 5000 applicants in recession-ridden '58 as compared to only 3500 in '59.

Engineering Convention Schedule

The 1960 edition of "Engineering and Technical Conventions" is now available from Industrial Relations News, 230 West 41st Street, New York 36. Price is \$4.00 per copy. Prepared annually by Deutsch & Shea, Inc., technical manpower consultants, the new report points up the problem of lost manpower through convention attendance.

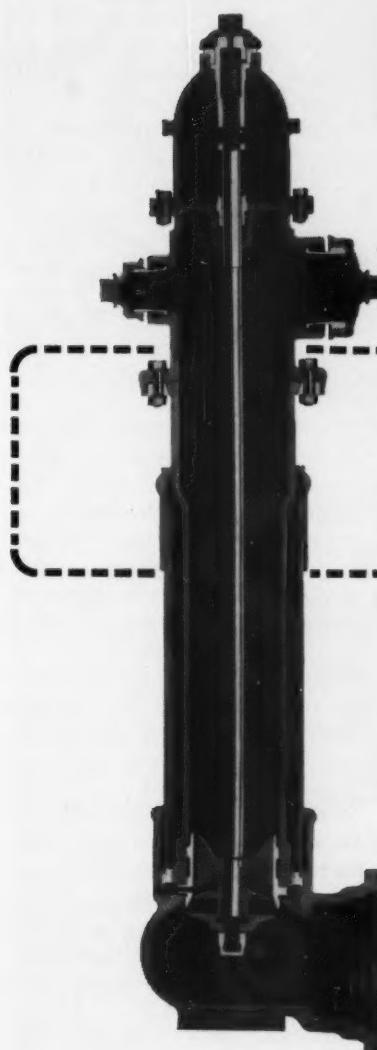
April, May, and October are peak convention months, with the heaviest concentration of meetings in Chicago, followed by New York and Los Angeles. Consulting engineer firms would do well to schedule their attendance plans, in an effort to maintain a balanced work force during the heaviest convention periods.

Selective Engineering Recruiting

While Cornell University's five-year engineering curriculum is paying dividends for recent graduates, an engineering diploma is no longer a passport to easy money, according to Donald H. Moyer of the Office of Student Personnel, College of Engineering.

Recruiters are placing more and more emphasis on the quality of engineering training, and while the top half of the current graduating class will have no trouble finding the right job, the below average student no longer can count on getting the right job, in the right place, and at the right salary. An inde-

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pendent survey showed that Cornell students were doing better than the average, with one graduate in engineering physics from last June starting at \$640 per month. Of all engineering groups, the civil engineers again showed up with the lowest starting salary.

Underground Parking for Topeka?

Only the mayor opposes underground parking, as proposed by the site committee appointed by the Topeka City Commission. The engineering firm of Burgwin and Martin says that underground facilities can be built for an estimated \$837,000, and bond experts have expressed the opinion that the city could market the bonds. The decision to proceed with planning of the proposed two-level underground facility now rests with the City Commission.

Profit Sharing Pays

Marc Showitz and Associates, Inc., engineering consultants in the electronic computer field, believe that profit sharing provides strong incentive for firm growth. Over 25 percent of the organization's 1959 profits was paid out in short-term incentives and rewards. In addition to continuing this program in 1960, the firm proposes to add a stock option plan. The current year's gross income is expected to double the 1959 figure.

Employee Tuition Assistance

Since its modest beginning in 1954, the tuition assistance program sponsored by Jackson & Moreland, Inc., Boston consulting firm, has grown to rather substantial proportions. During the 1958-59 academic season there were 103 J & M employee participants, and the firm's tuition bill ran to \$8898.

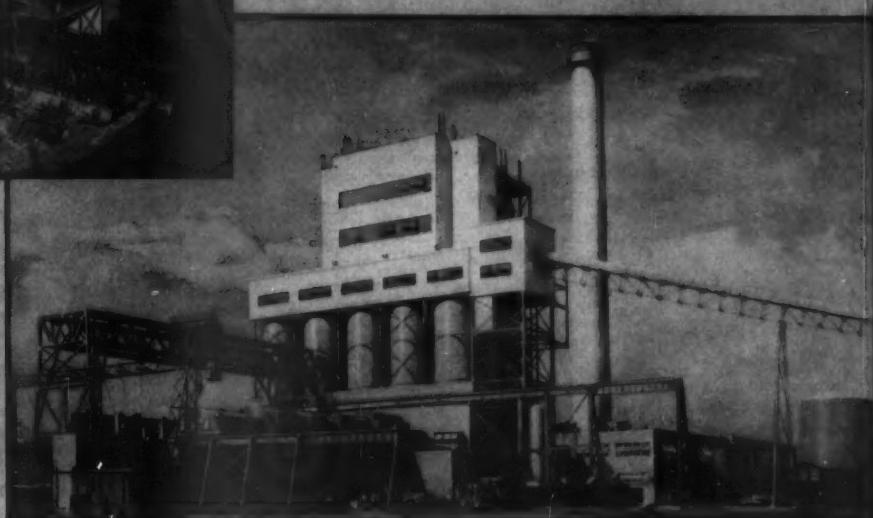
Originally, the J & M program offered half-tuition assistance for appropriate evening study, with a maximum of \$50. This was later increased to full tuition, with a maximum of \$125. During 1959 the \$125 maximum remained in force, but

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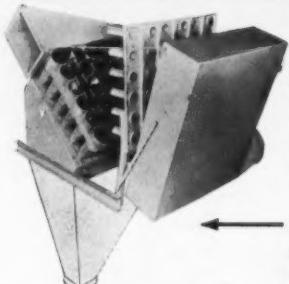
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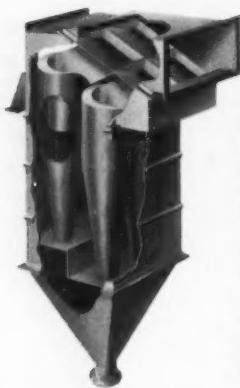
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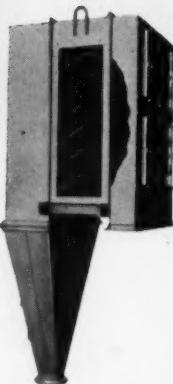


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only half-tuition could be charged to it. While most courses have been in the field of engineering, they also have included such widely diversified subjects as speed writing and management development.

Railway to Roadway

According to *The Economist*, there is a certain anti-railway lunatic fringe in Britain that longs to pull up all the rails, shoot all the iron horses, and turn the whole railway system into roads overnight. Proceeding at a more sensible pace, is the scheme of the Norfolk County Council, which has approved the purchase of 22½ miles of the Midland and Great Northern railway which was closed nearly two years ago. It intends to convert this right-of-way into a highway, and although certain sections will involve higher costs than reconstruction of the existing road, improved alignment will make the added cost justifiable. On the over-all project, use of the railway line will save £262,000, in spite of the added cost for some sections.

Meanwhile, here in the United States, Howard, Needles, Tammen & Bergendoff engineers are studying the problem of railroad relocation in downtown Orlando, Florida. Like many other American communities, Orlando is saddled with a railroad located according to the dictates of outmoded transportation requirements. But the community still needs the railroad, and the problem is to relocate it to upgrade property in the heart of the business district while keeping the cost of the project within recoverable limits. Present indications at Orlando point to a tangible contribution, to the more than \$1 million annual cost (spread over 30 years) of such a project, from the increased taxes that would come from upgraded property. If the final engineering study backs up the aesthetics with economics, the old railroad line may become the new Main Street of some of America's cities and towns. ▲▲



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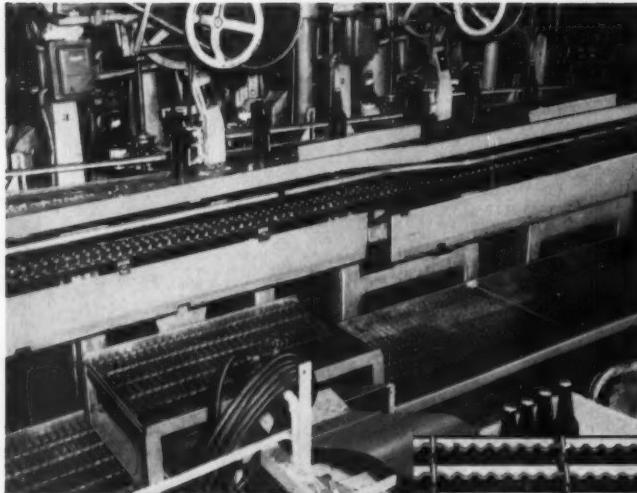
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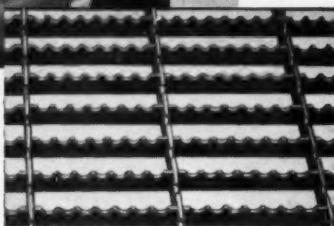
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Road Builders Back Engineers' Resolution

Ending his term as Engineering Division president with an important tactical operation in the consulting engineers' battle against the growing forces of government engineering, George B. Hills of Reynolds, Smith and Hills, maneuvered a meaningful resolution through the 58th Annual Convention of the American Road Builders' Association held January 18-21, in Cincinnati. Basically, the resolution calls for an adoption by the state highway departments of a uniform accounting system that will make it possible for them to accurately and honestly compare the cost of engineering design work by the departments' employee engineers with equivalent design work done for the departments by engineers in private practice.

The resolution also recommends the prequalification of engineering firms doing highway work for state highway departments and requests that this prequalification be required for all engineering firms engaged for design work on Federally aided projects.

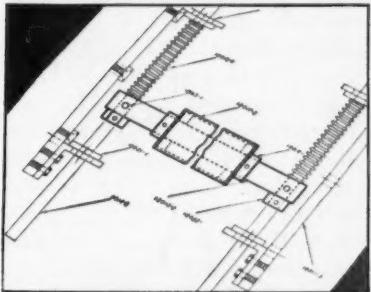
The resolution also asks Congress to clarify existing legislation so that there is no question but that consulting engineers may be used and, where advantageous, should be used for highway design work. Copies of the resolution were sent to the Comptroller General (who seems to have some unfortunate ideas concerning the use of consulting engineers by state highway departments), the Secretary of Commerce, the Federal Highway Administrator, the Public Works Committee of the House and the Senate, and the American Association of State Highway Officials.

Resolutions are easily come by, but this one is significant in that

drafting and printmaking NEWS

Ever Want Prints Emphasizing Parts of a Drawing?

Engineers, architects and many other types of technical people often want prints that separate key parts of a drawing from the rest of it, and some weird and costly techniques have been used. This is understandable because the cost of *not* getting good separation or emphasis can also be shocking. Take the case of a large West Coast engineering organization constantly involved in plant construction. They used sepia prints of floor plans to lay out the electrical work. But the lack of contrast between the plumbing shown in the sepia and the electrical layouts added required hours of careful checking and frequent revisions, even caused some expensive construction errors.



Diazo print from special-blue image intermediate produces a sharp contrast between the parts to be emphasized and those to be subdued.

That's all ancient history now! Two of Dietzgen's numerous modern drafting-printmaking aids have turned this tough old chore into a picnic. They are new drafting media (one a polyester film and

SOLVED: A COSTLY PROBLEM OF COMBINING DRAWINGS AND GRAPHS



Drafting time costing as much as \$40 was used to draw a single grid...and draftsmen resented the tedious assignment.

A large manufacturer of automotive parts decided to plot their graphs directly on the drawings in order to end the nuisance of their being separated in

the other a vellum) diazo sensitized to produce a special blue image. The reproduction of your basic drawing on either of these media is bold and clear so drafting additions can be made without confusion or error. But when you make prints from the completed intermediate, the basic part in the special blue prints faintly (clearly visible but subdued) . . . while the added drafting, even in pencil, prints strong and bold. The results are perfect, easily and quickly obtained, delightfully inexpensive.

handling, filing, plant interchange, etc. But this created many new problems. Tracing or drawing the grids in position proved costly, as much as \$40 each in drafting time. They were rarely accurate and never uniform in character. The lines often smudged and usually reproduced poorly. The work created a morale problem because draftsmen resented the tedious assignment.

One of Dietzgen's modern drafting-printmaking aids furnished a perfect answer! It is a light-weight drafting film which is adhesive-backed and furnished printed with a stock grid. It is simply mounted in place and the grids are sharp, clean, clear and uniform, so much more accurate that fewer plotting points are needed to develop the graphs. Reproductions were so noticeably better as prints moved through other departments and associated plants that the change was investigated and quickly adopted. Much needed drafting time and capacity is saved and the reduction in costs amounts to many thousands of dollars a year.

Drafting-Printmaking Handbook reports new techniques for solving engineering and production problems



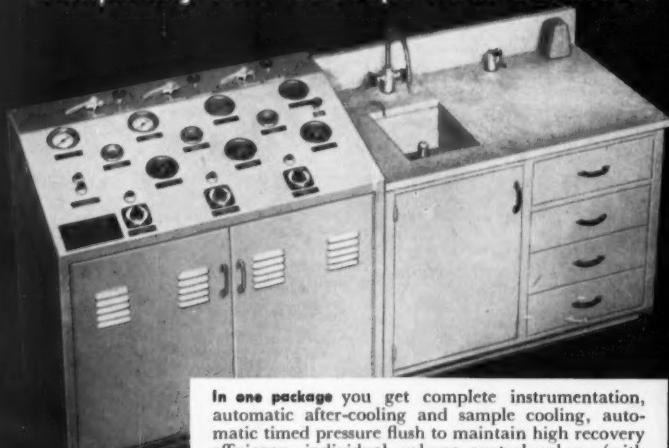
This new 36 page handbook describes a wide variety of engineering and production problems that have been solved with advance techniques in drafting and printmaking pioneered by Dietzgen. The concise, problem-solution approach suggests ways in which you may improve

the efficiency within your engineering department or eliminate production bottlenecks. Write today on your company letterhead for the Mechanics of Modern Miracles. Ask for Publication SPD2-A10. Eugene Dietzgen Co., Chicago 14, Illinois.

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it firmly puts all of the divisions of the American Road Builders' Association squarely behind the principle of uniform accounting for state highway departments and on record as favoring the use of consulting engineers in the highway program. This would be expected of the Engineering Division, which is composed of consulting engineer firms, but the other divisions also went along, and those other divisions include public officials, manufacturers, contractors, bankers, and educators. This resolution empowers the staff of ARBA in Washington to apply every effort to a program aimed at getting true cost data and encouraging the use of consulting engineers on public road design work.

At the general session that unanimously passed this resolution, Ellis Armstrong, Commissioner of the Bureau of Public Roads, and A. E. Johnson, Executive Secretary of the American Association of State Highway Officials were both on the speaker's platform, and it is worth noting that Armstrong made a change in his paper. Where the released text read, "[our plans and designs] represent the combined efforts of the large number of dedicated, hard working, experts (the world's best) that we have in our State Highway Departments and the Bureau of Public Roads," he added the phrase "and of our consulting engineers throughout the country" in his verbal presentation. Asked later to confirm this addition, he said, "Yes, sir, I did add that, and what's more, I meant every word of it."

All consulting engineers may not agree with the part of the resolution requesting a system for pre-qualification of engineers but the reason for it is to help highway departments get off an occasional hook on which they are hung by the politician who wants to get a project for a friend who claims to be a qualified engineer but has never been any closer to highway engineering than the time he ran

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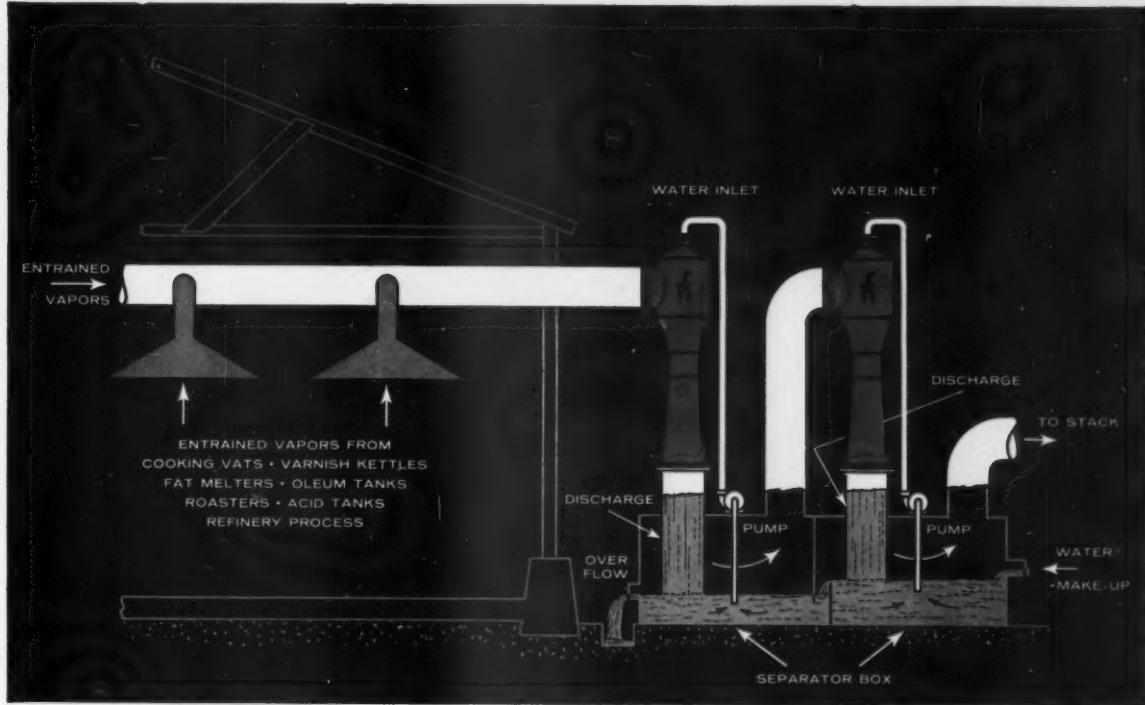
over a surveyor on Route 30. Prequalification would give the honest highway official a way out without hurting him politically. Furthermore, most bad engineering work on the highways has been done by inexperienced firms, and their failures have hurt the profession.

No one could agree to prequalification until a method of operation is established, but the committee working on it is headed by W. H. Corddry, of Gannett, Fleming, Corddry and Carpenter, a fully qualified engineer, and he assured the business meeting of the Engineering Division that he and his committee understood the difficulty of their task and would work closely with ASCE, AICE, NSPE, AASHO, and the Consulting Engineers Council in planning a system of prequalification for consulting engineers.

At this same meeting, Steve Meem, executive secretary of the division, stated that the membership of the division had grown from 104 to 140 firms during 1959 and that a new and acceptable dues formula based on number of employees engaged in highway engineering work had been worked out. Division income from dues last year came to about \$15,400, which means it is now paying its own way within the ARBA for the first time.

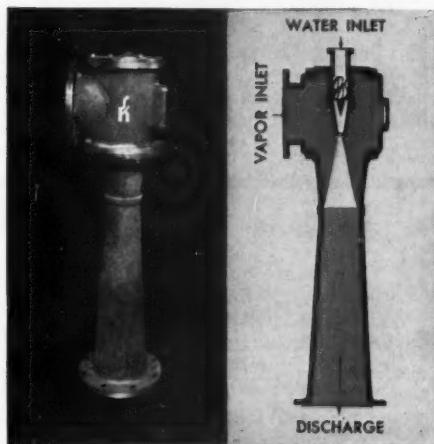
General Louis W. Prentiss, Executive Vice President of ARBA, told the meeting that he was most enthusiastic over the work of the Engineering Division, particularly in their publication of Bulletin 245 on scope of engineering services and fees for highway engineering work. He stated that he felt that the inauguration of this new division (now three years old) was the most important action of ARBA since he had been with it.

George Richardson, of Richardson, Gordon & Associates, took over the presidency of this Engineering Division, just two days after he completed his term of office as president of the American Institute of Consulting Engineers. □



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Photo and sectional drawing of
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A. J. Eichmuller (right) and Day-Brite representative
Tony Dunn examine the Day-Brite CFI-30.

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More light for less money with Day-Brite CFI® fixtures!

That's "Operation UPlight". The new Day-Brite CFI (Comfort For Industry) fixtures are designed to deliver the higher lighting intensities currently recommended . . . yet substantially reduce installed, operating and total owning costs. And now, with prices reduced as much as 17.7%, Day-Brite CFI fixtures are within the range of every industrial lighting application.

For actual cost figures comparing Day-Brite CFI fixtures with other lighting systems, call your Day-Brite representative listed in the Yellow Pages. See for yourself why hundreds of companies across the country have put "Operation UPlight" into action, making it the most successful program in Day-Brite history. PHONE TODAY!

*per footcandle for each 10,000 square feet. Based on 4,000-hour operation, 1¢ per KWH rate, 35% lamp discount, typical maintenance cost, and amortizing the cost of buying and installing the lighting units over a ten year period.



Day-Brite Lighting, Inc.
St. Louis, Mo. • Santa Clara, Calif.

NATION'S LARGEST MANUFACTURER OF COMMERCIAL
AND INDUSTRIAL LIGHTING EQUIPMENT



KEY-KAST® Long Tangent Elbows provide uniform strength

KEY-KAST Long Tangent Welding Elbows will give you outstanding service in any high pressure, high temperature alloy piping system. They are the *only* long tangent elbows with cast steel walls of uniform thickness and strength. Nipples and extra welding are eliminated — long tangents can be provided at either or both ends.

Quality controlled through the most rigid metallurgical standards, Key-Kast Elbows meet ASTM specifications, and ASME and ASA code requirements.

Call your Key-Kast representative for prompt, experienced service in selecting the Key-Kast Long Tangent Elbow best for you. Available in all standard sizes and schedules with tangent lengths as long as half the O.D. of the connecting pipe . . . and specially designed to meet specific conditions of pressure, temperature and loading.

Products of W-K-M's Creative Engineering

W-K-M

DIVISION OF **ACF INDUSTRIES**
INCORPORATED
P. O. BOX 2117, HOUSTON, TEXAS

Uniform Wall Elbows

Key-Kast Long Tangent Elbows have uniform cast steel walls approximately 15% heavier than the required minimum thickness of pipe walls of the same I.D. For extra highly stressed line sections, the wall thickness can be increased as much as desired — without sacrificing uniformity.

The flexibility of Key-Kast Elbows permits their use in piping systems based on the usual piping stress calculations. Write for engineering bulletin entitled "Key-Kast Welding Elbows in Piping Stress Calculations," for W-K-M's Quality Control Specifications No. 102958 (conventional steam power) and No. 103058 (nuclear power).

Key-Kast Fittings can handle any piping job. Specify them. You'll get outstanding service.





Men in Engineering

Two top engineers have been named vice presidents at Wilsey and Ham Engineers and Planners, of San Francisco and Los Angeles, in a reorganization which also includes a change in the name of the firm. Effective this month the firm becomes Wilsey, Ham and Blair.

Charles T. Blair is vice president and chief engineer. His main responsibilities include projects involving structures and Federal government agencies. He also supervises operations of the Los Angeles

dent, and five directors elected to three-year terms are: Norman L. Bryan, of Reynolds, Smith & Hills, Jacksonville, Florida; W. H. Corddry, of Gannett, Fleming, Corddry & Carpenter, Harrisburg, Pennsylvania; Guy Kelcey, of Edwards & Kelcey, Newark, New Jersey; Earle V. Miller, of Johannessen, Girard & Miller, Phoenix, Arizona, and Murray A. Wilson, of Wilson & Company, Salina, Kansas.

H. W. Slack and M. C. Westrate have been elected directors of Commonwealth Services Inc., New York City management consulting firm. Both men are officers and directors of Commonwealth Associates, Inc., Jackson, Michigan, engineering affiliate of Commonwealth Services.

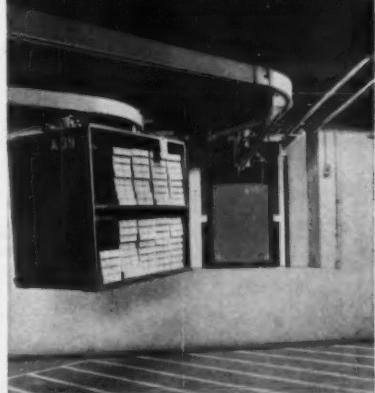
Herbert Hoover has been added to the advisory council of the Society for the History of Technology. The Society which was founded at Case Institute of Technology, in January 1958, also has announced plans for the publication of a new journal, *Technology and Culture*. Other members of the advisory council are U. S. Senator Ralph E. Flan- ders; Dr. Mervin J. Kelley, retired chairman of the Bell Telephone Laboratory; Major Lennox R. Lohr, director of the Museum of Science and Industry in Chicago; and Lewis Mumford, noted writer. Dr. D. B. Steinman is president of the Society.

At its 58th Annual Convention held in Cincinnati last month, the American Road Builders' Association's Engineering Division elected George S. Richardson, of Richardson, Gordon, and Associates, Pittsburgh, Pa., as president. He succeeds George A. Hills, of Reynolds, Smith & Hills, Jacksonville, Fla.

J. Stephen Watkins, Louisville, Kentucky, was named vice presi-

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WITH TELEOMATIC AUTOMATIC DISPATCH CONTROL



* Simply set dials and Telematic guides carrier to any station in system



POWER RAIL FREE RAIL

Employs exclusive unitized "over and under" power and free rail which permits simple switching to right or left as desired.

Power-Flex is designed for automated materials forwarding applications in industrial plants, distribution centers, service buildings and department stores. The most economical system available for loads up to 600 lbs. per carrier. Savings in actual installations range from 25% to 60%. *Systems in service for your inspection.

Engineered to your very specific requirements.

SEND FOR BROCHURE

Inquiries from your engineers or consultants welcomed.

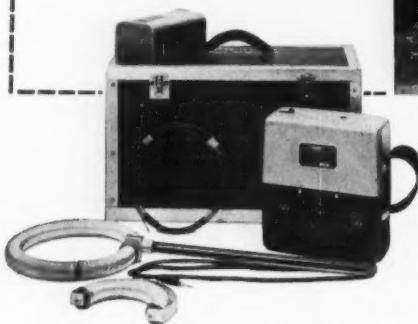


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*Portable, "damp-climate,"
 pulse type holiday detector
 for coated surfaces.*

To obtain maximum protection and hold maintenance costs to a minimum, inspect protective coating with a Tinker & Rasor Holiday Detector and make repairs before backfilling. Minutes spent inspecting the pipe with a Tinker & Rasor Holiday Detector while the ditch is open can save days making repairs later on. Clearly, if protective coating is desirable, the best possible protective coating is most desirable.

Every holiday in your protective coating increases the current requirements of cathodic protection. The result is constantly increasing maintenance costs.

Insure your pipeline's future with inspection by Tinker & Rasor Holiday Detectors. Write today for technical data and bulletin.

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To insure a successful application, your specification should include TR Holiday Detector inspection. Write for specification guide.

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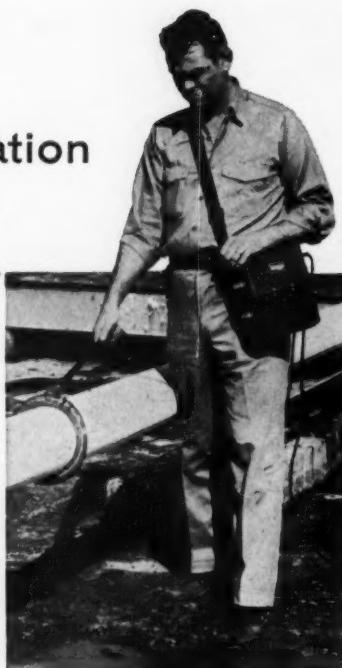
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impact of technology on society. Its headquarters are at Case Institute of Technology and Dr. Melvin Kranzberg, professor of history at the Institute, is secretary.

T. Cortlandt Williams, president since 1955 of Stone & Webster Engineering Corporation, has been elected chairman of the board. Fred W. Argue, executive vice president, has been elected president to succeed Williams in a se-



WILLIAMS ARGUE

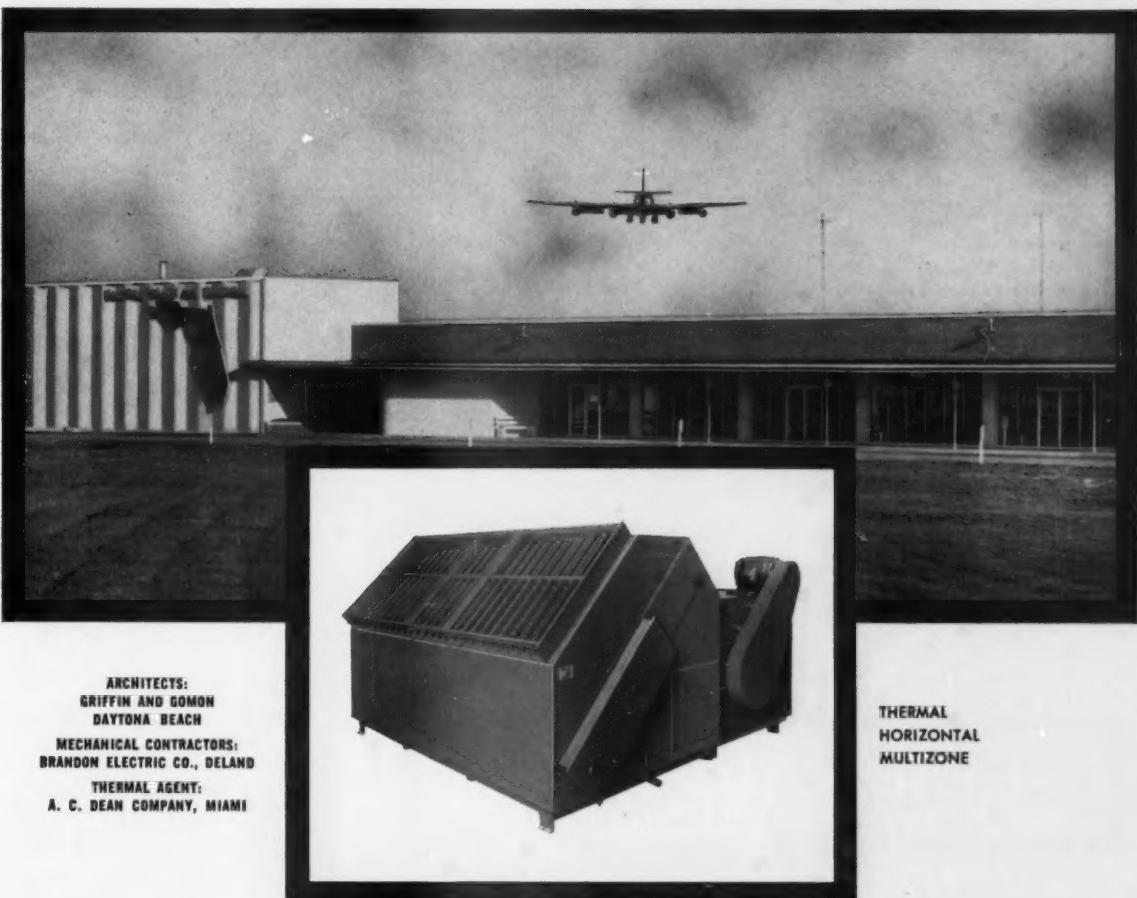


HARTRIDGE GOOD

ries of top management changes of the firm effective last month.

Other management changes include the election of Alfred L. Hartridge, financial vice president and treasurer, as executive vice president, and of the designation of Dr. Arthur J. Good, vice president and comptroller, as vice president and treasurer.

Louis R. Howson, prominent Chicago consulting engineer, has been named the "Chicago Civil Engineer of the Year, 1959" by the Illinois Section of the American Society of Civil Engineers. Howson, a past president of the Society, was cited for "excellence in his profession, leadership in the Society, and for his humanities." Howson is senior



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Keeping Air Travelers Comfortable on the Ground

To match the comfort and luxury of today's air travel, architects and engineers give considerable study to the design of and equipment needed in air terminals. Among the country's outstanding terminals in this aspect is the one found at Daytona Beach, Florida.

And here again, as in more and more outstanding buildings, Thermal Engineering's equipment is in use. Both cooling and heating are being furnished by Thermal multizone and central plant units to provide year 'round air conditioned comfort on the ground for air travelers.

Thermal Engineering manufactures a complete line of finer air conditioning and ventilating equipment for every climate and to fit all architectural requirements. To see how easily, economically and efficiently Thermal equipment will fit into your new building or remodeling plans, write for the complete catalog on Thermal central plant and multizone conditioners, sprayed coil units, heating and ventilating units, heating and cooling coils, and air-cooled condensers.

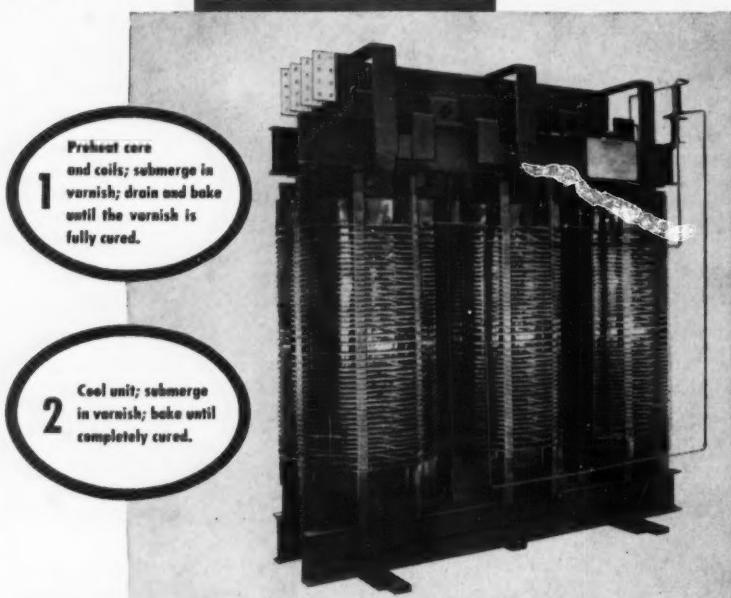
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TYPICAL OF HEVI-DUTY TRANSFORMERS



Two impregnations with polymerizing varnish,
baked twice for utmost protection

What makes a good transformer? For one thing—polymerizing varnish applied the Hevi-Duty way. It's another reason why Hevi-Duty transformers—single and three-phase up to 3000 KVA—have long service life and provide extra protection during periodic overload conditions.

At Hevi-Duty it's standard practice to specially treat the core and coil with a moisture and corrosion resistant polymerizing varnish. It's also standard practice to perform two separate baking operations. This assures complete and permanent impregnation so that there are no solvents given off after installation. Nor does the varnish soften under heat. Polymerization cross-links the varnish constituents, changing the soluble, penetrating resins into an infusible, insoluble mass of extreme bonding strength that cannot soften or run at extreme temperatures. The bonded molecules produce a compound that is dry throughout the most compact of coils, eliminating all soft or sticky spots. The resultant transformer is highly resistant to corrosion and impervious to attack from chemical fumes, alkalies, acids, salt water and oil.

Polymerizing varnish also has excellent dielectric properties and helps reduce the sound level by bonding the laminations and components together.

Long drying and baking cycles and the use of polymerizing varnish are standard features on Hevi-Duty transformers. You can be sure of obtaining these features by specifying Hevi-Duty transformers or by writing the following into your specifications: "Double Impregnate Coils and Core with Polymerizing Varnish; Bake until Varnish is Completely Cured."

HEVI-DUTY

A DIVISION OF



For more information
on Hevi-Duty Dry
Type Transformer
design features, write for
Bulletins 100 and 200.


HEVI-DUTY ELECTRIC COMPANY, MILWAUKEE 1, WISCONSIN
Industrial Furnaces and Ovens, Electric and Fuel • Laboratory Furnaces • Dry Type Transformers • Constant Current Regulators

partner of Alvord, Burdick and Howson, and he is a registered engineer in 30 states.

Masami Tanaka, Tokyo architectural designer, has been selected as the recipient of the first Welton Becket Working Fellowship, to be awarded annually to a young Japanese architect by Welton Becket and Associates, architects and engineers, Los Angeles. Yukio Hasumi, Consul General of Japan at Los Angeles, said Tanaka will join Becket's staff for a one-year period.

Tanaka was selected by Becket and his design staff from three finalists chosen by the Japan Architects Association from a wide field of applicants. A five-man Association committee narrowed the field of applicants through review of



HASUMI

BECKET

their backgrounds and samples of their work, a design test, an oral interview, and an English proficiency test. Final selection was made by the Becket group on the candidates' architectural design ability and personal and professional qualifications.

The firm of Cleverdon, Varney, and Pike, consulting engineers, of Boston, Massachusetts, announces that John A. Dow, heating, ventilating, and air conditioning engineer, has been made a partner. Other recent appointments include: Roger F. Curry, head, mechanical department; Harold E. Proctor,



Greater Structural Beauty with **Reinforced CONCRETE**

The Northern Illinois Tollway Bridge across the Fox River at Aurora is a picture of grace and beauty. Here, designers wanted to enhance the entire toll highway project with a monumental-type structure. Reinforced concrete, because of its greater design freedom and construction flexibility, was used to achieve the intricate and unusual design of thin braced barrel arch spans.

Reinforced concrete is the logical, economical solution to every type of bridge design. Complicated curves and unusual shapes are easily obtained. It is lower in first cost, requires less maintenance, and is highly resistant to wind, shock, and quakes. In addition, materials and labor are readily available from local sources—your project starts on time and finishes on schedule.



Concrete Reinforcing Steel Institute
38 South Dearborn Street
Chicago, Illinois

Northern Illinois Toll Highway Bridge over Fox River Valley, Aurora, Illinois
Owner: The Illinois State Toll Highway Commission
Designing Engineers: Vogt, Ivers, Seaman & Associates, Cincinnati, Ohio
Consulting Engineers to the Commission: Joseph K. Knosle & Associates,
Baltimore, Md.
General Contractor: CKG Associates, Elgin, Illinois



Impressive design of this outstanding open spandrel structure features five reinforced concrete braced barrel arches only 14 in thick. Each arch spans 178 ft and is on a circular radius of 133 ft.

HUNTING FOR **LARGE** CONSTRUCTION FASTENERS?



HERE'S YOUR RELIABLE SOURCE...

- Two modern plants — an 88 year manufacturing background of dependable service.
- Made by skilled craftsmen, specializing in standard and custom made fasteners, 1½ inch bolt diameter and larger, engineered to your requirements.
- Thousands of successful installations in bridges, power plants, docks, heavy machinery, dams, locks, etc.



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EYE BARS • LOOP RODS
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**NEW BULLETIN ON
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Every engineer needs this free digest of large fasteners. Write for Bulletin 160, Joseph Dyson & Sons, Inc., 5155 St. Clair Ave., Cleveland 3, Ohio, Phone HE 1-6157.

DYSON

head, electrical department; Floyd E. Brown, head, civil department, and Donald M. MacLean, chief structural engineer.

Delmer C. Dean, structural engineer with Benham Engineering Company, Oklahoma City consulting engineering firm, has been elected chairman of the Oklahoma City branch, American Society of Civil Engineers, for 1960. Elected to serve with Dean are Gerald Emerson, vice chairman, and Howard L. Russell, secretary-treasurer.



DEAN TRINKS

C. L. Willibald Trinks, teacher and engineering manager and consultant for almost 60 years, has been named "Man-of-the-Year" in Engineering in Pittsburgh, Pennsylvania. Trinks was honored with 15 other special award winners at the 20th annual Pittsburgh Junior Chamber of Commerce "Man of the Year" Dinner, January 18. The winners, selected by a committee of 27 prominent citizens, were selected as the most outstanding contributors to Pittsburgh's industrial and civic progress, and to their representative fields of interest in the past year. In 1940, Trinks started an organization known as Associated Engineers; at 85, he is still active in the firm and is working on the fifth edition of *Industrial Furnaces*, first published in 1922 and known as the furnace engineers' bible.

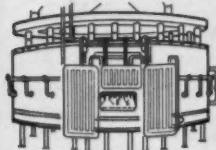
Engineering Consultants, Inc., of Denver, Colorado, has moved to new and larger quarters at 1901 S. Navajo. The new \$100,000 build-

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ADAPTS TO YOUR HEAT TRANSFER PROBLEM



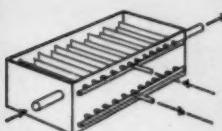
ALL TYPES
OF TANK AND
PROCESS HEATING
AND COOLING



OVEN AND
FURNACE USES



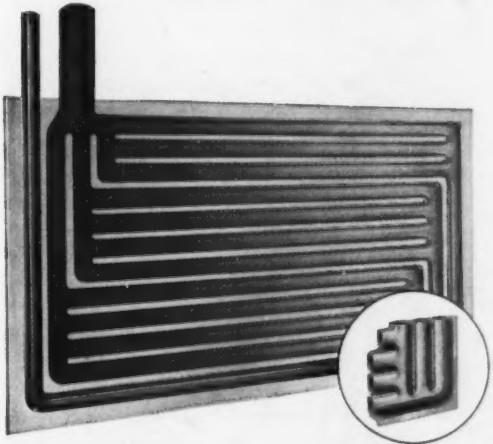
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WASTE HEAT
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PLATECOIL is the versatile, factory fabricated answer to heat transfer problems of all kinds. You can apply PLATECOIL to all types of tank and process heating and cooling — open tanks, closed tanks, agitated tanks, deep tanks, jacketed tanks, sumps, kilns, ovens and many others. Basic PLATECOIL types include header and serpentine designs in single embossed, double embossed, flat, rolled and banked units. They are available in mild steel, stainless steel, Monel, Ni-o-nel, Hastelloy B, Hastelloy C, nickel, and many other metals. Special designs, surface finishes, structural parts and connections add to their versatility. Operating pressure now rated up to 250 psi.

NEW MULTI-ZONE* PRINCIPLE PRODUCES MORE EFFECTIVE HEAT TRANSFER



Multiple headers with multiple condensate returns provide better steam distribution and more total effective heat transfer area in the new MULTI-ZONE PLATECOIL. FREE-FLO action, without condensate trapping increases processing production through faster "start-up" and extremely fast temperature recovery. This reserve capacity also holds temperature variations to a minimum. PLATECOIL eliminates problems of engineering, fabricating, installing and maintaining pipe coils. PLATECOIL units are lightweight and easy to handle. They are compact and save tank space. Deposits do not build up on streamlined PLATECOIL surfaces as they do on pipe coils. All stainless steel and alloy PLATECOIL units affected by cold working are annealed and pickled after fabrication to return the metal to its original condition and thus eliminate the probability of corrosion due to internal stresses and carbide precipitation. PLATECOIL is also relatively simple and economical to remove, clean and re-install. In most cases there is no need for threaded joints within the solution to corrode or leak.

Investigate the possibilities of PLATECOIL for your specific problem.

*Patented
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P85 for more data.

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**RED WATER?
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**Eliminate these problems
with GFC Aerators
and Filters**

Iron and corrosive, odorous gases cause red water, leaky pipes and clogged meters. Unless corrected, these problems will result in loss of revenue, and consumer complaints.

GFC Forced Draft Aerators and Filters can solve these problems. They are designed for easy assembly, dependability and long life.

Ask about our new aluminum and fiberglass Aerators. Write for your copy of our new Aerator and Filter Plant bulletins with design data and problem analyses.

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WATER PROCESS EQUIPMENT AMES, IOWA

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FLASH MIXERS • FLOCCULATORS • PNEUMATIC CONTROLS
ROTARY DISTRIBUTORS • SLUDGE SCRAPERS

ing houses the 29 engineers on the home office staff, plus 22 Thailand engineers who are participating in a training program with the firm.

Ben Maccabee, president of Maccabee and Associates, Chicago firm of design engineers, has been named president of the Jewish Information Society.

D. B. Steinman, Consulting Engineer, has taken into partnership his associates R. M. Boynton, C. H. Gronquist, and J. London. These associates have been with Dr. Steinman for over 30 years and have been identified with him in the design and construction of over 400 bridges. The firm name has been changed to Steinman, Boynton, Gronquist & London, Consulting Engineers.

The firm Sydney H. Stilley and Associates, consulting engineers, has moved its offices to Suite 503, Florida Baptist Building, 1230 Hendricks Ave., Jacksonville, Fla.

Charles Luckman Associates, planning, architectural, and engineering firm, has moved its New York offices to larger, new quarters in the Canada House on Fifth Avenue. The firm also occupies its own office building in Los Angeles.

Capitol Engineering Associates has opened a new Ohio office in the East Ohio Gas Company Building, St. Clair & Erie Streets, Painesville, Ohio. J. William Fisher is the resident representative.

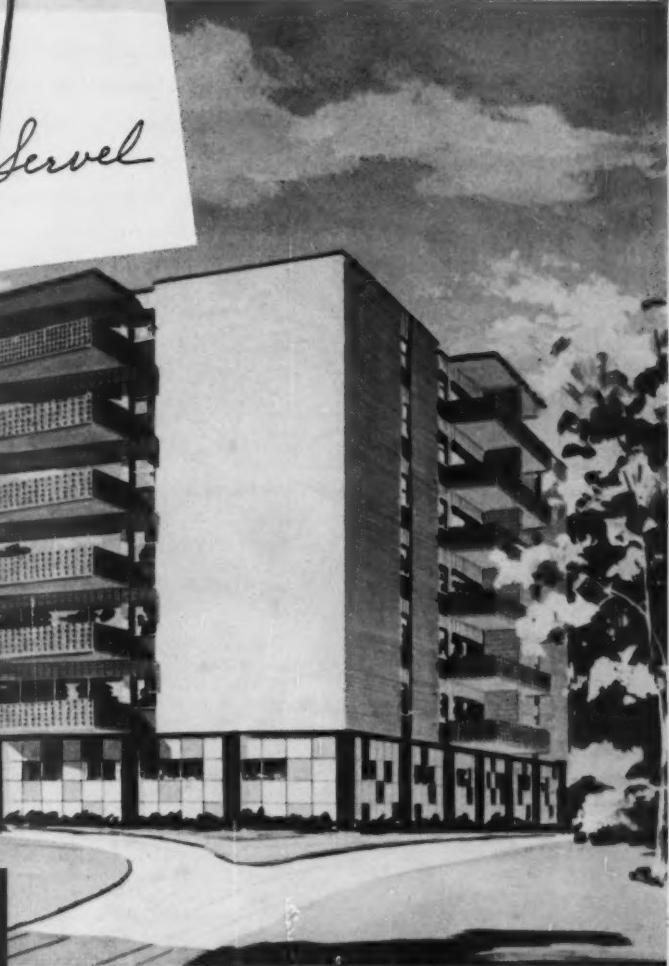
William T. Ingram, Consulting Engineer, with offices at 20 Point Crescent, Whitestone, New York, has opened a West Coast office at 90 Panoramic Way, Walnut Creek, California, with Fred R. Ingram as associate in charge of that office. The professional services offered by both offices provide sanitary engineering consultation concerned with control of environment and, they include water purification,

*Specified:
Gas & Arkla Servel*



*Harry Sugar (left), one of the builders,
and designer Matthew J. Rosenstock*

*Individual **GAS**
units to cool and heat
new \$2 million
apartment house*



*Akron's 7-story Carlton House to be
cooled with individual Arkla-Servel units*

Akron's luxurious Carlton House will mark the largest use of individual gas air conditioning units in a single apartment house.

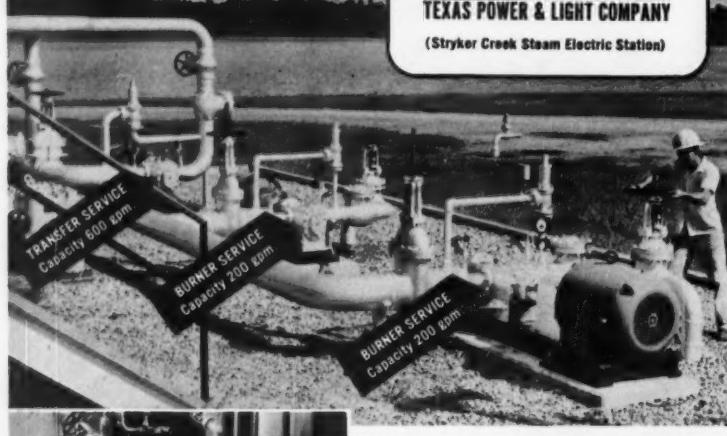
Summer cooling and winter heating will be provided for the suites by 58 three-and-a-half and five ton Arkla-Servel Sun Valley gas air conditioners.

The Arkla-Servel gas air conditioning units were chosen after serious consideration of all types available. The designer insisted that each apartment have individual thermostat control as well as individual installations to eliminate the need for large compressors and any possible vibration. Because gas is also used for cooking as well as heating and cooling, there was no need for installing heavy cable, either.

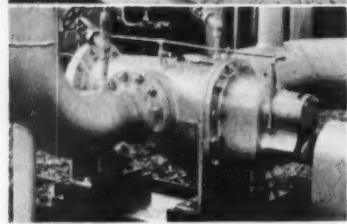
Check the facts and you too will see that modern Gas air conditioning out-performs all others. For specific details call your local Gas Company's air conditioning specialist, or write to the Arkla Air Conditioning Corporation, General Sales Office, 812 Main Street, Little Rock, Ark. *American Gas Association*

*for Cooling, **GAS** is Good Business*

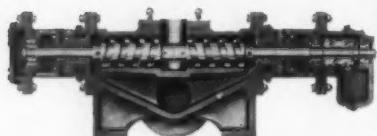
Sier-Bath SCREW PUMPS



—installed for stand-by
Fuel Oil Transfer and Fuel
Oil Burner Service
at
TEXAS POWER & LIGHT COMPANY
(Stryker Creek Steam Electric Station)



Sier-Bath SCREW PUMPS



External Gear and Bearing Bracket Type for non-lubricating liquids and semi-liquids



Internal Gear and Bearing Type for lubricating liquids and semi-liquids

Sier-Bath ROTARY PUMPS



Screw Pumps



Garex® Pumps



Hydrex® Pumps

Founded 1905

Mfr. of Precision Gears, Rotary Pumps, Flexible Gear Couplings

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sewage and industrial waste treatment, air pollution control, industrial hygiene, and related research planning and design.

Bennet W. Burns, a member of the firm of H. E. Bovay, Jr., consulting engineers, Houston, was installed as president of the San Jacinto Chapter of the Texas Society of Professional Engineers at its December meeting.

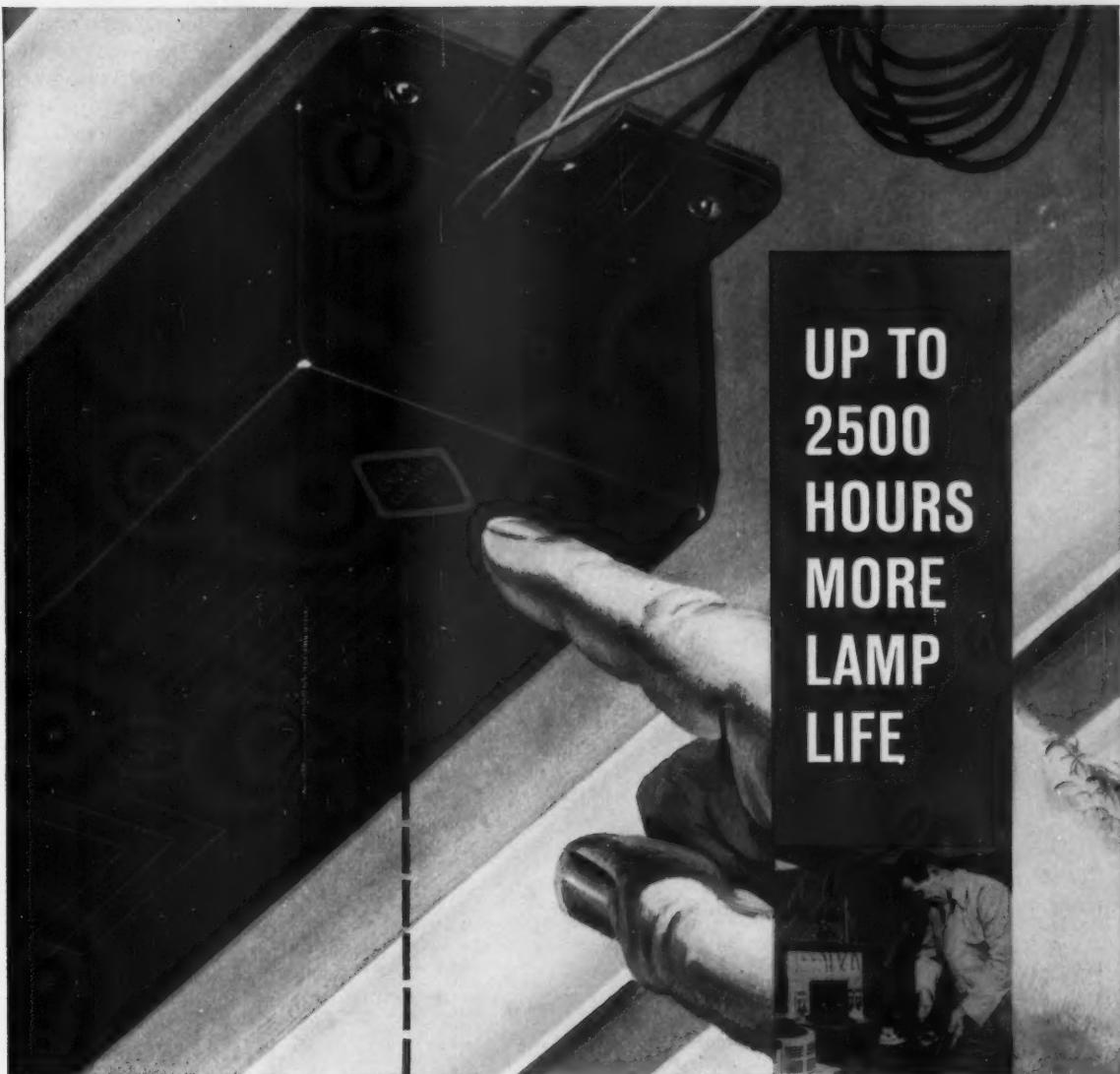
Joseph W. Guyton has joined the traffic engineering section of Harland Bartholomew and Associates in their St. Louis Office. Guyton was employed as a research assistant at the University of Illinois while studying for his masters degree. Since leaving the University, Guyton has spent two years in the Corps of Engineers as an instructor in nuclear weapons at the U. S. Army Engineer School, Fort Belvoir, Virginia.

Jones, Henry and Williams, consulting specialists in water, sewerage, and sewage treatment systems, have moved to new headquarters at 2000 W. Central Ave., Toledo, Ohio.

Voorhees Walker Smith Smith & Haines announces the appointment of six new associates. Those promoted are Benjamin Bailyn, John Delavan, Lee Economides, Robert Lundberg, John Loughnane, and Allen Nathanson.

Carl A. Schlegel, a vice president and member of the board of directors of United Engineers & Constructors Inc., Philadelphia, has retired from active service with the firm. Schlegel has been associated with United Engineers and its predecessor companies since 1910. His entire business career has been in association with the gas industry.

The firm of Theodore J. Kauffeld, M.E., P.E., Consulting Engineer, and its wholly owned subsidiary, Devenco Incorporated with executive offices in New York City and



UP TO
2500
HOURS
MORE
LAMP
LIFE

CBM Ballasts are checked by tests regularly, at E.T.L.

*And this is
one of many
advantages
which this
emblem
on a fixture
BALLAST
assures you!*



Because this CBM emblem on a ballast case means checked and certified by Electrical Testing Laboratories to definite CBM specifications . . . "Specs" that assure high light output, positive starting, Power Factor correction . . . dependable, rated performance from fluorescent lamps.

And of course, UL listing. They bring other benefits, too . . . savings on installation (fewer circuits needed for fixtures CBM-equipped) and more light (from the same number of fixtures).

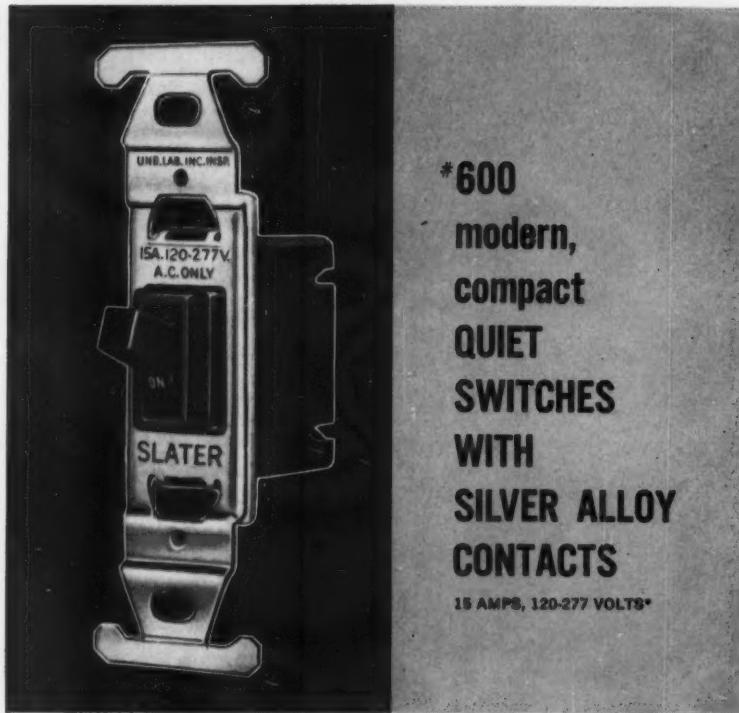
It pays to specify fixtures equipped with CBM ballasts. For the latest facts, ask us to send you CBM News.

Participation in CBM is open to any manufacturer who wishes to qualify.

CERTIFIED BALLAST MANUFACTURERS, 2120 KEITH BUILDING, CLEVELAND 15, OHIO

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SPECIFICATION GRADE... LIFETIME WIRING DEVICES



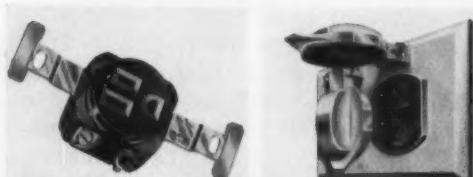
***600
modern,
compact
QUIET
SWITCHES
WITH
SILVER ALLOY
CONTACTS**

15 AMPS, 120-277 VOLTS*

The Slater #600 is the newest, quietest wall switch designed for fast, easy installation... cuts installation time more than 50%. In addition, the #600 features special silver alloy contacts, no-arcing characteristics. It will accept two #12 or #14 wires for thru wiring — patented side release permits use of ordinary screwdriver.

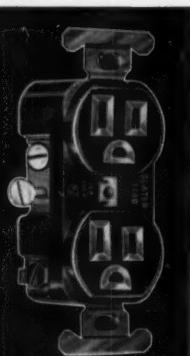
Engineering Excellence is the heart of Slater leadership in wiring devices. This is because years-ahead thinking, planning and performing at Slater is based on widest experience, backed by modern facilities that are unsurpassed in the field.

Technical Superiority in construction, materials and production techniques assure Slater contractors unexcelled benefits in function and durability, as well as initial and long-range economy.



#5261—specification grade single grounded receptacle, 15 Amps, 125 Volts*

#3783—Weatherproof Flip-Lid with #3200 "U" ground receptacle, 15 Amps, 125 Volts*



#3200—3 wire grounding, duplex receptacle, 15 Amps, 125 Volts*
*Other Ratings Available

WRITE FOR THE LATEST SLATER CATALOG COVERING
Appliance Switches, Lampholders, Power Outlets, Receptacles, Switches, Weatherproof Devices and Wall Plates

Slater

ELECTRIC & MFG. CO., INC.
45 Sea Cliff Avenue, Glen Cove, New York

Newark, New Jersey, announce the appointment of Herbert F. Ohmeis as vice president and manager of the field engineering division. Ohmeis previously was publisher of *Automotive Retailer* magazine.

Ralph C. Hilton and Jack B. Nance have formed a partnership for the practice of engineering in the fields of civil, structural, and sanitary engineering. The new firm, Hilton & Nance, Consulting Engineers, is located at 3817 Fannin Street, Houston, Texas. Hilton has been a consulting engineer in Houston for the past 14 years and Nance recently resigned as president and general manager of Maryland and Pennsylvania Railroad Company, Baltimore, Maryland. Hilton and Nance both began their engineering careers with Missouri Pacific Railroad, in San Antonio, Texas.

Sargent & Lundy, Chicago consulting engineering firm, has announced a number of year end changes in their partnership and organization. Andrew R. LeBailly, partner and chief engineer, reached retirement age and resigned from the partnership, effective December 31, 1959. Henry C. Schroeder, partner and formerly chief mechanical engineer, succeeds LeBailly as chief engineer. Harry H. McMeen, a partner since 1951, now is chief mechanical engineer.

John J. Walsh, mechanical engineer, has been admitted to the partnership. Walsh has been with the firm since 1947 and was appointed an associate in 1956.

In other action, Robert W. Patterson, a member of the firm's mechanical engineering staff since 1947, was appointed an associate.

S. O. Linzell, who recently announced his resignation as Deputy Director of Operations of the Ohio Department of Highways, has rejoined Michael Baker, Jr., Rochester, Pennsylvania consulting engineer as a midwest engineering representative. Linzell first became as-

COBO HALL EXHIBITION CITY

Detroit's Cobo Hall and Convention Arena, with 51 acres of floor space, will be the largest exhibition hall in the world. Since it was necessary to design for extremely heavy floor loading and maximum clear span, composite steel construction was selected by the architects and engineers for lowest cost.

50,000 NELSON stud shear connectors were welded to the top flanges of the floor beams to insure permanent bond between the structural members and the concrete floor slab.



NELSON stud shear connectors were chosen to develop composite construction for several reasons...the ease with which reinforcing bars could be positioned, better concrete compaction, ability to take stresses in all directions, their speedy installation and the absence of any distortion inherent in hand-welded shear devices.

For complete service from design to installation, write: Nelson Stud Welding Division, GREGORY INDUSTRIES, INC., Dept. 14, Lorain, Ohio.

*A steel and concrete composite beam is made up of three essential elements: A steel beam, a reinforced concrete slab, and shear connectors. Horizontal shear is transferred to the beam through the shear devices which join the slab to the beam in such a way as to cause the concrete and steel elements to act as a unit.



NELSON Stud Shear Connectors end-weld at rate of 4 or more per minute.

Architects and Engineers: Giffels and Rossetti
General Contractor, Superstructure: O. W. Burke Co.
Structural Steel Contractor: R. C. Mahon Company
Shear Connector-Applicator Contractor: Bodrie Corp.

NELSON
Stud Welding

a cost-saving product of

GREGORY INDUSTRIES, INC.

LORAIN, OHIO



sociated with the Baker firm in 1957 after having served as State Highway Director for four and one half years. He resigned his post with Baker in January 1959 to return to the Highway Department as Deputy Director of Operations.

The following members of Albert Kahn Associated Architects and Engineers, Inc. have been elected associates of the firm: R. Hudson, C. M. Labunski, J. Nachbar, J. S. Pettitt, and S. D. Popkin. Pettitt and Popkin are registered architects, specializing in institutional and commercial work; Hudson is a registered civil engineer in the firm's estimating division; Labunski is an electrical engineer; and Nachbar is a mechanical engineer.

The Austin Company, international engineering and construction firm, Cleveland, Ohio, has established a new company in Argentina to handle the growing volume of its industrial building business in

that country from headquarters in Avda. Pte. Julio A. Roca 610, Buenos Aires.

Cyril F. Prideaux has been named president of the new firm which will be known as AUSTIN, Ingenieria y Construcciones, S. A., Comercial, Inmobiliaria e Industrial. Prideaux, who is continuing as president of Austin's Brazilian company with headquarters at Sao Paulo, will direct the staff responsible for Argentine location surveys, plant design, engineering, and construction work.

Gustav Gegauff, P.E., structural engineer, has moved his office to 286 North Broad Street, Elizabeth, New Jersey.

William C. Pittam, project engineer for Stone & Webster Engineering Corporation in charge of work on expansion of the Georgia-Pacific pulp and paper mill at Toledo, Oregon, has been promoted to consulting engineer. Pittam

joined Stone & Webster in 1955 after working for Weyerhaeuser Timber Company, and has been engaged in the design and construction of pulp and paper mills.

The R. T. Patterson Company, Inc. has opened offices at 350 Grant Building, Pittsburgh, Pennsylvania, and announces a greatly expanded operation in the field of consultation, engineering, management, and construction of industrial, utility, and steel enterprises. Principal of the firm, R. T. Patterson, formerly was president of Patterson-Emerson-Comstock, Inc.

Walter P. O'Farrell, widely known throughout the engineering and construction field, has been elected a member of the board of directors of J. H. Pomeroy & Co., Inc., international contracting and engineering firm, San Francisco.

Announcement also has been made of the appointment of C. William Maxeiner, prominent California attorney, as senior vice president and general counsel.

Gunnar Eeman has been named an associate engineer of Russell S. Fling & Associates, consulting structural engineers, Columbus, Ohio. For the past ten years, Eeman has worked in Toledo, Ohio, being associated with the offices of both Bellman, Gillett & Richards and also Raymond C. Reese.

Robert F. Kane, public relations director and advertising manager for F. H. McGraw & Company since 1948, has resigned from McGraw and has opened his own public relations firm in New York. The new firm will be known as Robert Francis Kane & Associates with offices at 51 East 42nd Street. Kane will continue to represent McGraw on an agency basis. Because of his long experience in the engineering and construction field, Kane will specialize in publicity accounts in the building field as well as in the general industrial field. □

Your ideal source for custom-designed cranes

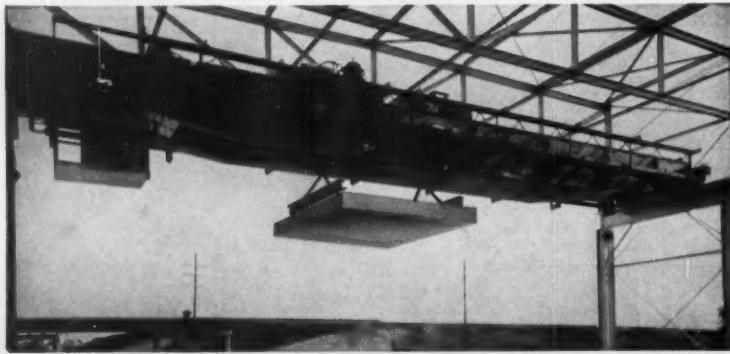
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A crane, custom-tailored in every detail to your client's needs, is available from Conco at a practical cost. Here you'll find engineering experience spanning 35 years, and unique plant flexibility that permits easy handling of specialized cranes—spark and explosion proof, indoor-outdoor, circular, and cranes employing closed circuit TV for remote-control operation. May we submit a proposal on your next crane requirement—whether standard or highly specialized?

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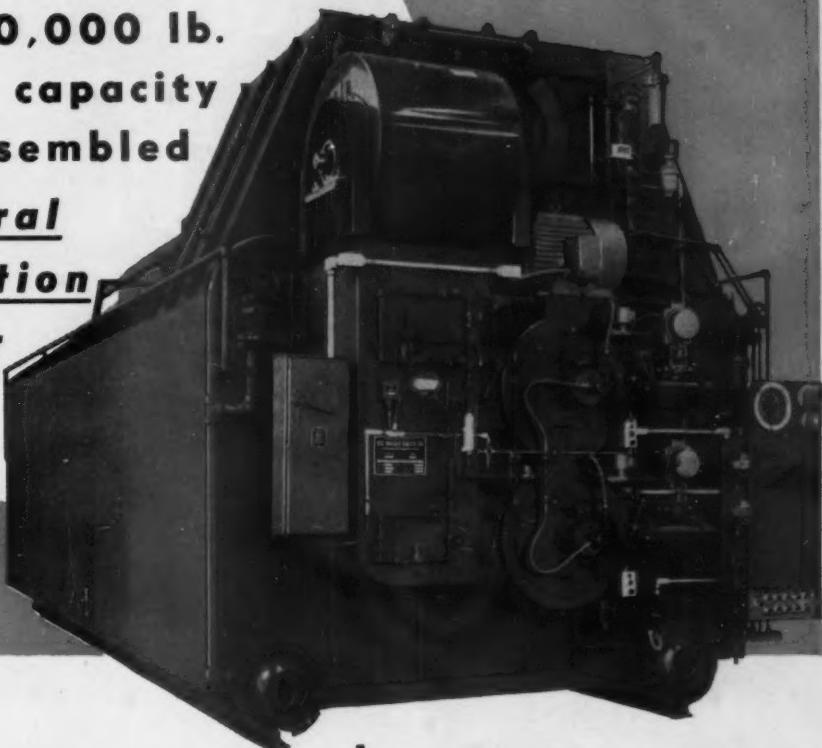
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shop-assembled
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boiler



Wickes Type A units are of simple design, ruggedly constructed and adaptable to a variety of operating conditions and may be fired with oil, gas or combination of both.

All units are shipped completely shop-assembled including superheater, fuel burning equipment, safety and combustion controls, forced draft fan and drive, soot blowers and feedwater regulator.

Save on

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RECOGNIZED QUALITY SINCE 1854 • SALES OFFICES: Boston • Chicago • Cleveland • Dallas • Denver • Detroit
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Westinghouse develops new motor starters with “monkey proof” safety features



Check these
6 great new
safety "firsts"...

SAFE—You always know whether power is on or off because ON-OFF handle is permanently attached to disconnect... even when door is open.

SAFE—Positive gasket seal keeps out oil and dust. An interlock requires that door must be tightly sealed before handle can be moved to ON position.

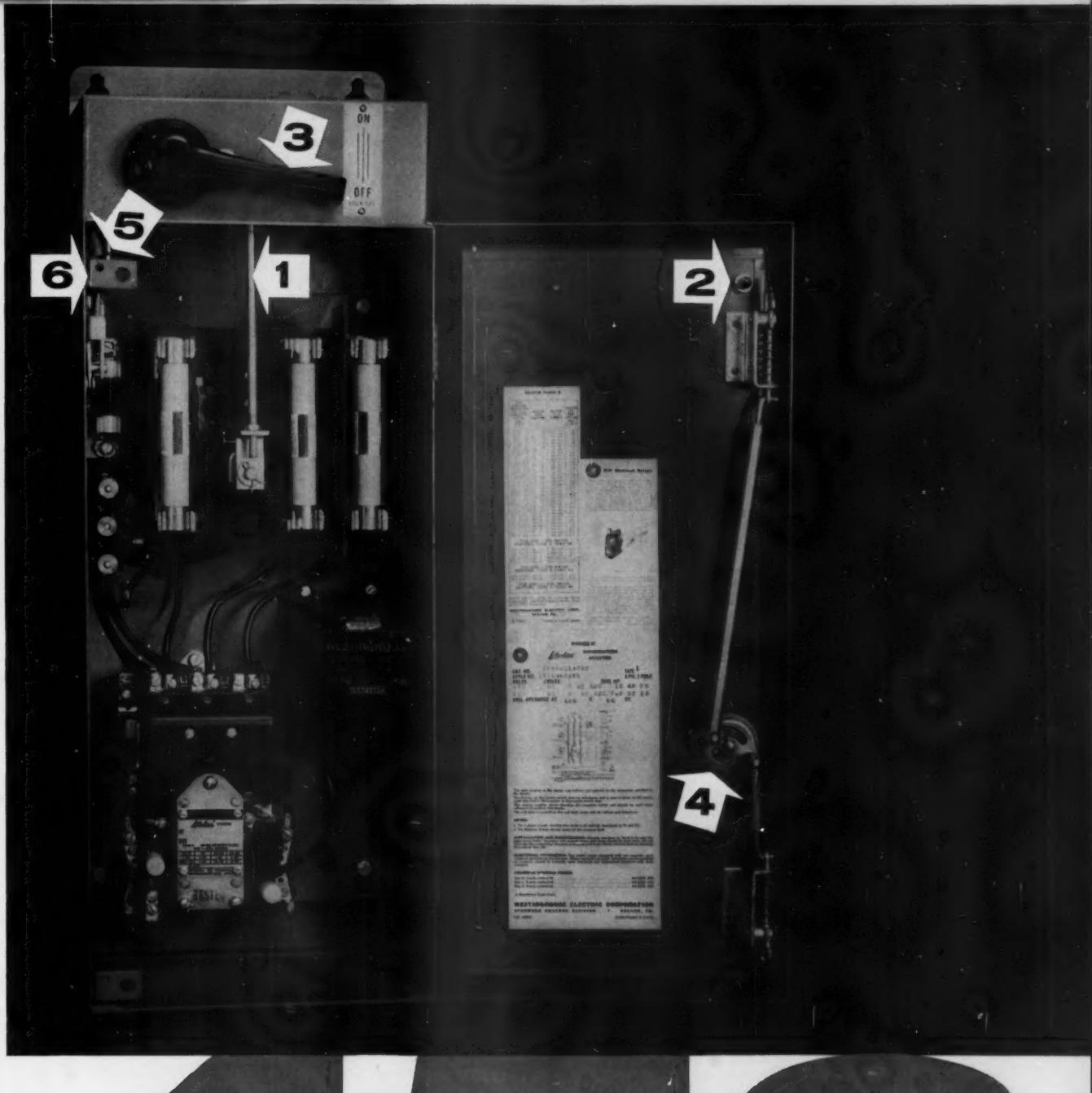
SAFE—Even when you're out of sight, padlocking ON-OFF handle prevents any operation of disconnect regardless of whether door is OPEN or CLOSED.

YOU CAN BE SURE...IF IT'S

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SAFE—Discourages tampering by unauthorized personnel. Tool required to open door.

SAFE—Accidental operation of disconnect impossible when door is open. Disconnect interlock must be deliberately voided to operate ON-OFF handle.

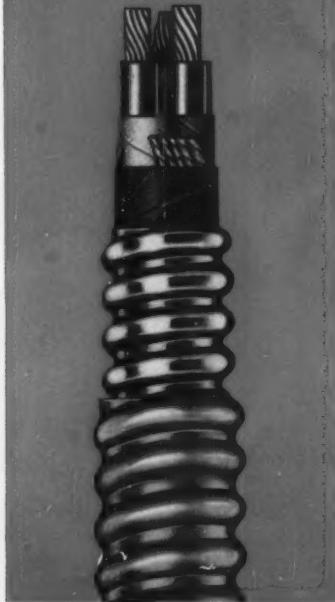
SAFE—Interlock prevents door from being opened when switch is on. ON-OFF handle must be in OFF position to open door.

J-30306

C-L-X INTEGRATED CABLE SYSTEM

Requires no separate Duct or Conduit
in any environment

Unusual pliability of C-L-X Sheathed Cables is shown here as the cable is being installed.



The revolutionary C-L-X Continuous, Corrugated, Light-weight, metallic sheath, that Simplex introduced to this country two years ago, is now available in *Aluminum, Copper or Bronze* as well as the enormously successful *Steel*.

Simplex C-L-X pliable cable systems provide unexcelled ease of installation and mechanical protection.

The *corrugated* metal sheath combines pliability for ease of installation with very great strength and seals the cable against penetration by oil, chemicals and moisture.

Depending on the environmental conditions of the installation, these power, control and communication cable systems can be furnished with or without plastic jacketing.

Light, and pliable, C-L-X cables are easily installed, and require no special reels.

Now, with corrugated *Aluminum, Copper or Bronze* sheathed C-L-X cable systems, the low resistance of these metals permits designs where the sheath may be used as a neutral or ground. These metals also permit the use of single as well as multiconductor cable assemblies in a-c power systems.

For complete details on C-L-X sheathed cables, contact your Simplex Engineer, or write direct.

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Reporting The New Projects

Consultants Evaluate Railroad

The New York consulting firm of Ford, Bacon & Davis, Inc., was authorized recently by Federal Judge Archie O. Davis to undertake a study of the present day value of the railroad properties and business of the bankrupt Hudson & Manhattan Railroad Company.

The H & M operates the Hudson Rapid Tubes commuter line between Hoboken, Jersey City, and New York and, jointly with the Pennsylvania Railroad, it operates a similar service between the Hudson Terminal and Newark. Speculation is raised as to possible interstate transit development. For example, all the Hudson ferries could be discontinued and provision made for connections with the New Jersey railroads and the New York City transit system. The whole project could be handled as a public enterprise.

Aluminum Municipal Building

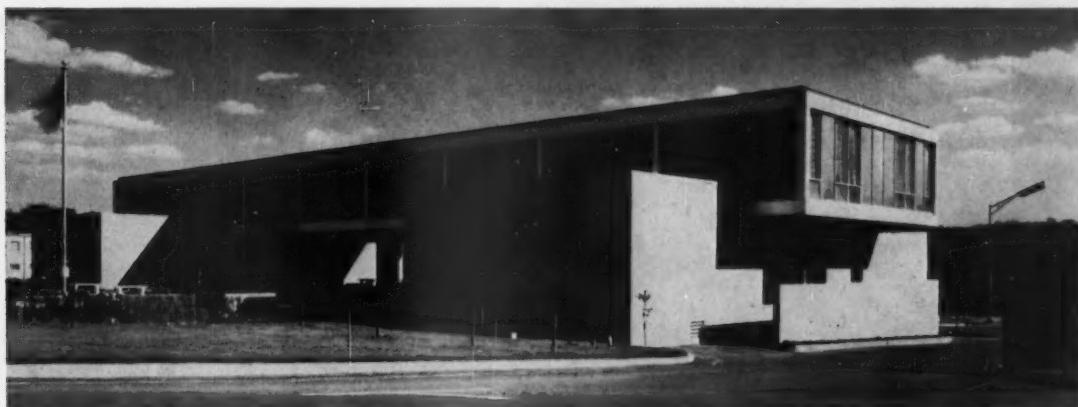
More than 35,000 pounds of aluminum went into the new municipal building recently completed in New Kensington, Pa. New Kensington was the original "aluminum city" and the site of the first full-scale aluminum operation in 1891. Aluminum curtain wall construction is featured and many aluminum trim items, including lighting fixtures, hand-



rails, door frames, and other hardware were used in the interior. Black porcelain enamel on aluminum was used around the top and bottom of the structure for the coping and gravel stop. Campbell & Green, of Sewickly, Pennsylvania, was the architectural-engineering firm responsible for the complete design of the building.

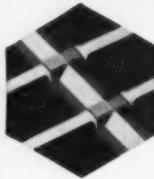
Project Matterhorn

Commonwealth Associates, Inc., of Jackson, Michigan, are supervising the construction of two new buildings for Project Matterhorn. This project has been authorized by the Atomic Energy Commission and concerns the harnessing of energy derived from thermonuclear fusion. One of the interesting features of this project was the use of silicone waterproofed asbestos-cement panel for thin, low cost exterior wall. Insulation board was sandwiched between flat asbestos-cement sheets forming 1 9/16-in. thick panels which were waterproofed on the site



Municipal building for New Kensington, Pa., uses trim of both aluminum and porcelain coated aluminum.

Gary welded steel grating



with the
hexagonal
cross bars

Greater stability, greater safety, under foot! Proved under all conditions, in millions of square feet of open flooring and stair treads, Gary's hexagonal cross bar design together with square edge strip, assures a more durable, safer grating. Pressure welded construction forms cross bars and main bars into a rugged one-piece grating. Tops of all bars are flush.

Factory-fabricated to your specifications. Whatever your needs in type and size, Gary Grating saves you installation time and money. Rigid quality control assures dimensional stability and neat appearance.

Gary Grating can also be furnished in a variety of stainless steels and also aluminum.

For all your functional and decorative grating and stair tread requirements, specify Gary Grating ... steel or aluminum. It's designed for lasting satisfaction. Write for free catalog—Dept. B, 4045 E. Seventh Ave., Gary, Indiana.



ROCKWELL-STANDARD
CORPORATION
GRATING DIVISION, GARY, INDIANA

with a new silicone compound called Supertox. These sheets were then fastened to the structural steel framework by angle bracket hooks. The result is an attractive, well-insulated wall produced at a low cost and requiring only a minimum of routine maintenance.

Stockholm International Airport

Arlanda, Stockholm's partially completed international airport, will begin operations in April 1960 when Scandinavian Airlines System (SAS) initiates scheduled international service with DC-8 jet airliners. By 1963 the airport construction will be finished. It will have a capacity of 1.2 million passengers per year. Still to be completed are the permanent administration building, which is still in the planning stage; additional runway facilities; and a new high-speed highway to Stockholm, 25 miles away.

Arlanda is nine times as large as Bromma, the present international airport for Stockholm and covers an area of 6250 acres. Designed for jet aircraft, its main runway is two miles long and can accommodate aircraft weighing up to 220 tons with a four-wheel landing gear (a fully loaded DC-8 weighs a little over 140 tons). The runway was constructed in 18 months, well ahead of schedule, by Skansa Cementgjuteriet, one of the largest Swedish contracting firms. Over 585,000 cubic yards of rock were blasted loose and a total of 3.25 million cubic yards of earth had to be removed from the construction site.

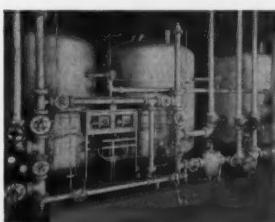
One of the major problems encountered in the construction was draining and stabilizing the clay-based parts of the airport. Steel pipes were forced down to a depth of 25 to 40 feet and then filled with wet sand. The pipes were then withdrawn and the sand pillars left to act as reinforcement and drainage channels. Altogether, some 50,000 pillars were used. In addition, almost 100,000 feet of pipe have been laid for horizontal drainage. The Swedish Board of Civil Aviation has budgeted a total of \$30 million for this project.

Cantilever Construction in Hangars

While the Swedish government is developing Arlanda Airport, the Scandinavian Airlines is spending over \$5 million on a new jetliner maintenance hangar at the same location. The building was designed by the company's engineers in collaboration with the contractors, SIAB, Swedish specialists in industrial structures. It consists of a multistory central body with a heavy frame of cast-in-place concrete, while the walls and roofs are of light-concrete slabs. The cantilever roof is suspended on either side of the nucleus by 70 mm (2.758 inches) thick steel cables, forming two bays capable of



Bruner equipment supplies soft water for Michigan State University's Kellogg Center, including the new \$500,000 wing (above). Consulting Engineers for the Center: Kenneth Phelps, Ann Arbor; Gene Stender, Battle Creek. Architect: L. J. Sarvis, Battle Creek. Plumbing Contractors: R. L. Spitzley Co., Detroit; J. A. Dart Co., Lansing; United Piping & Erecting Co., Lansing.



BRUNER Water Softeners protect plumbing investments at Kellogg Center and 10 other Michigan State buildings

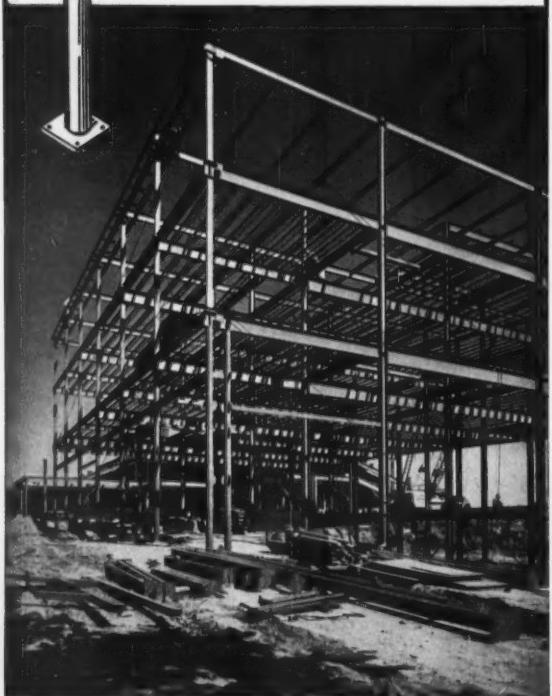
Leading engineers across the country specify Bruner water softeners and filters, America's most complete line. Full information is available from Bruner Sales Offices in all major cities.
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Concrete Filled columns, widely used in contemporary building featuring versatility and beauty, adds strength—prevents corrosion. Shown below—round, square and rectangular concrete filled columns are used on a construction project providing elements in safety, beauty, strength and economy. Specify Tubular Products columns on your job. For more information, write Tubular Products, Souderton, Pennsylvania.

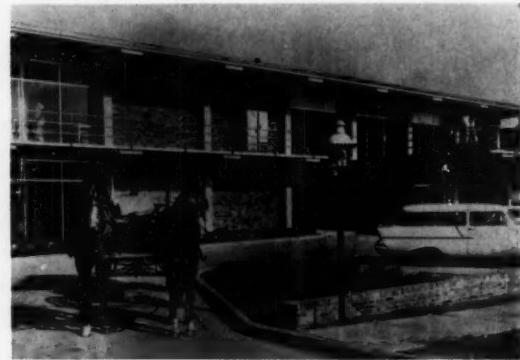
TUBULAR
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Souderton, Pennsylvania



housing two DC-8 aircraft each. The bays have sliding doors of corrugated aluminum on steel frames. Each door is 53 feet high, 79 feet long, and weighs 25 tons. By 1963, this hangar will have been extended to provide ample housing for four additional large aircraft.

All-Gas Motel

The utility rate structure in the state of Arkansas favors the use of gas. When the Coachman's Inn in Little Rock was being planned, this factor was fundamental in the decision to use an all-gas plant. Today, the Inn uses gas not only for heating, air



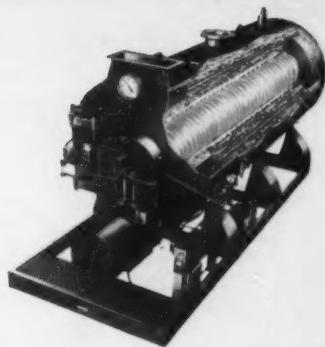
Little Rock motel is entirely gas operated, including 200 kw output gas engine-generator combination.

conditioning and cooking, but also to generate all its own electricity and to provide dramatic outside gas lamp lighting. The only use of electricity is for food refrigeration equipment and the lighting of interior space.

There are 40 oversized gas street lamps ringing the motel, and more than 100 smaller gas lights illuminating the sidewalks and passageways. Gas lights line the passage between the lobby and the interior court, and an antique gas chandelier graces the large meeting room which is provided in the Gaslight Suite.

Air conditioning is provided by six 25-ton absorption units connected in parallel. As the load decreases the chillers shut themselves down one by one. The beauty of the system, as the owners put it, is that input decreases proportionately as capacity decreases, whereas with compression equipment, this is not generally the case.

The chillers operate from steam produced in a low-pressure gas-fired boiler, rated at 8400 Btu per hour input. This same boiler provides heating in cold weather, water being diverted from the chillers



$$h_A = (0.41 + 0.09 \frac{T}{1000}) \frac{\sqrt{0.79}}{D_0.16 L 0.05}$$

$$q = CA \left[\left(\frac{T_1}{100} \right)^4 - \left(\frac{T_2}{100} \right)^4 \right]$$

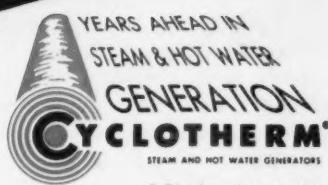
Here's a Quick Refresher Course on Combustion Principles . . .

A Cyclotherm Sound Film-Strip that you and all your engineering friends should see

Every engineer interested in combustion should be sure to see the Cyclotherm sound film-strip, *Heat Transfer and Cyclonic Combustion*. Written by engineers, from a professional, not a promotional, point of view, this film is a quick refresher course in the principles of boiler engineering. *For engineers only* — too many mathematical formulae for the man-in-the-street to follow.

Cyclotherm has also prepared a manufacturing film which shows, step by step, how Cyclotherms are built. Beginning with the flat plate arriving from the steel mills and finishing with the complete boiler shipped to the customer, this film illustrates what we mean when we say that "one manufacturing responsibility is behind the entire equipment."

We'll be glad to arrange for an early showing of both these films. Invite other engineers in your company, as well as members of any engineering group to which you belong. You can see each film in 20 minutes — and you'll find them 20 minutes very well spent. For full information, write us today.



A Division of National-U.S. Radiator Corp., 57 E. First St., Oswego, N. Y.



Anaheim Bowl Sound Engineer* specified ALTEC

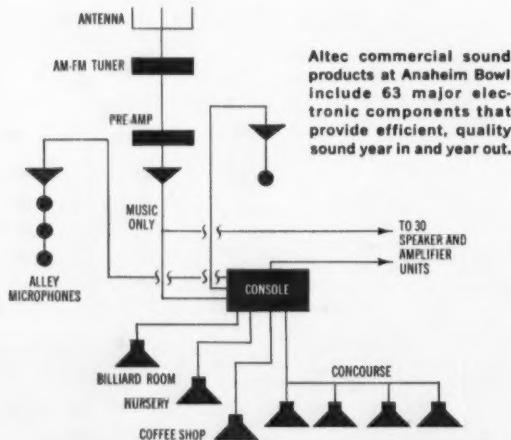
At the Anaheim Bowl recreation center in Southern California; at Disneyland; government buildings in Washington, D.C.; International Amphitheatre in Chicago; Mormon Temple in Los Angeles; in stadiums, auditoriums, hospitals, schools, churches, shopping centers, in government, commercial and industrial buildings all over the world—you'll find ALTEC Engineered Sound Products.

That's because ALTEC sound systems, like all ALTEC products, are designed for dependable service under all conditions, for long life, and for ease of installation and service.

And it's because of the hundreds of ALTEC engineer-consultant-contractors who are ready to serve you with more than 100 different ALTEC commercial sound components and/or systems designed to your specifications.

Before you specify commercial sound equipment, you'll want to talk to your nearest ALTEC contractor. For his address look in the Yellow Pages of your Telephone Directory or write to ALTEC at address below.

*California Sound Products, Inc. Anaheim, Calif.



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to a heat exchanger. Each room has a fan-coil air-handling unit that circulates hot or cold air depending on the temperature of the water in the coil. In summer, a step controller cycles the chillers off and on as needed, while in cold weather, a single outside thermostat controls the temperature of the water circulating in the coils.

Two 300-hp natural gas engines power the 200-kw generators which furnish the electricity for the Inn. The engines alternate every 700 hours, allowing ample time for maintenance. Only under the most extreme loads are both engines used.

Vance Thompson, president of the Coachman's Inn, feels that the decision to go all-gas has been thoroughly proven in the first three months of operation.

"In September, our highest month yet, we used 4267 cubic feet of gas, at an average cost of 29.6¢ per cubic foot," Thompson said. "The bill ran to \$1268."

"We have a kilowatt meter on the switchboard of our generators, which shows how much electricity the Inn has drawn. Applying the power company rate that would be charged if we drew our current from the outside, we figure our electric bill would have been about \$2350. We also estimate that we saved an additional \$450 by bleeding heat from the generator engines to provide us with a good supply of hot water."

The Coachman's Inn has 124 rooms plus a kitchen, dining room, lobby, three banquet rooms, swimming pool, and a sunken patio. Total cost of the motel was \$1.4 million. Consulting engineer was Byron Jenkins, P.E., whose firm is located in Little Rock, Arkansas.

Richvale Project for Feather River

License application for a large water and power development on the Middle Feather River in California has been filed with the Regional Engineer, L. S. Wing, of the Federal Power Commission. Called the Richvale Irrigation District, the project will embrace extensive water storage requiring the construction of eight dams and a chain of five power plants with a total capacity of 300,000 hp and costing \$120 million.

Glen R. Harris, Board Chairman of Richvale, states that this application culminates six years of detailed engineering design study under the direction of F. E. Bonner, consulting engineer, of San Francisco. The increased water supply will alleviate current shortages in serving the irrigation requirements of the Richvale-Yuba City locality. Neighboring public agencies associated with Richvale in this enterprise are the Butte Water District, Biggs-West Gridley District, and the Sutter Extension District. These four districts operate the extensive



WINTER OLYMPICS, Squaw Valley, Calif.

ARCHITECTS:
Corlett and Spackman, A.I.A.,
Kitchen and Hunt, A.I.A., Architects Associated,
San Francisco
CONSULTING ENGINEERS:
Vandament and Darmstedt, San Francisco
MECHANICAL CONTRACTOR:
W. L. Hickey Company, San Francisco

Young CONNECTORS

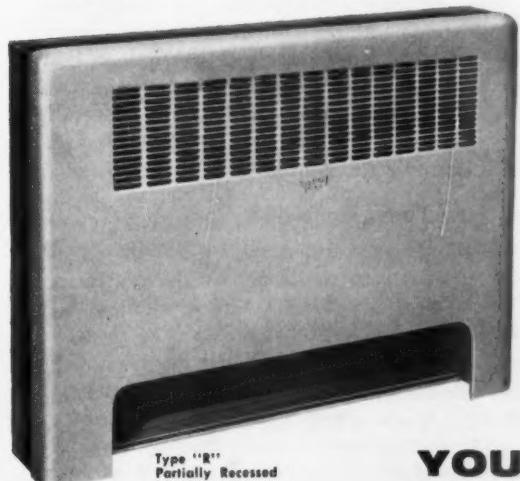
efficiently heat
Winter Olympic
Games dormitories

The world's greatest athletes from 34 nations will enjoy the warmth and comfort of the world's finest convectors. To provide the best in heating comfort over 400 Type "FS" sloping top free standing and Type "R" partially recessed Young Convectors were specified and installed in the four 3-story dormitories housing athletes competing in the Olympic Winter Games. These units efficiently heat every room in the four buildings . . . exceed the high quality standards required for this installation.

To get more details on the full line of Young Convector-Radiators, ask for Catalog 4059.

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NEW

8

blade

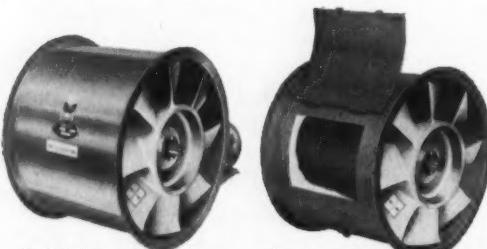


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**tubeaxial
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high speed - high efficiency

Aerovent's new Tubeaxial Fan, designed around a new 8-blade "Macheta" Airfoil Axial Flow Propeller, offers top performance against medium pressures at speeds to 3450 RPM. Available in 16", 18", 24", and 30" diameters, this unit combines speed, stamina and modern functional design. Easily installed in present ductwork or engineered to new construction, it's the right answer for resistances to 4" SP. Another outstanding development from Aerovent—America's finest industrial fans and air equipment.



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Sutter-Butte Canal system and contain more than 100,000 acres of productive irrigable farm land.

Little Rock Sewage Plant

The Little Rock Sanitary Sewer System engaged the Burns & McDonnell Engineering Company early in 1957 to prepare a report covering the need for sewage collection and treatment facilities to serve



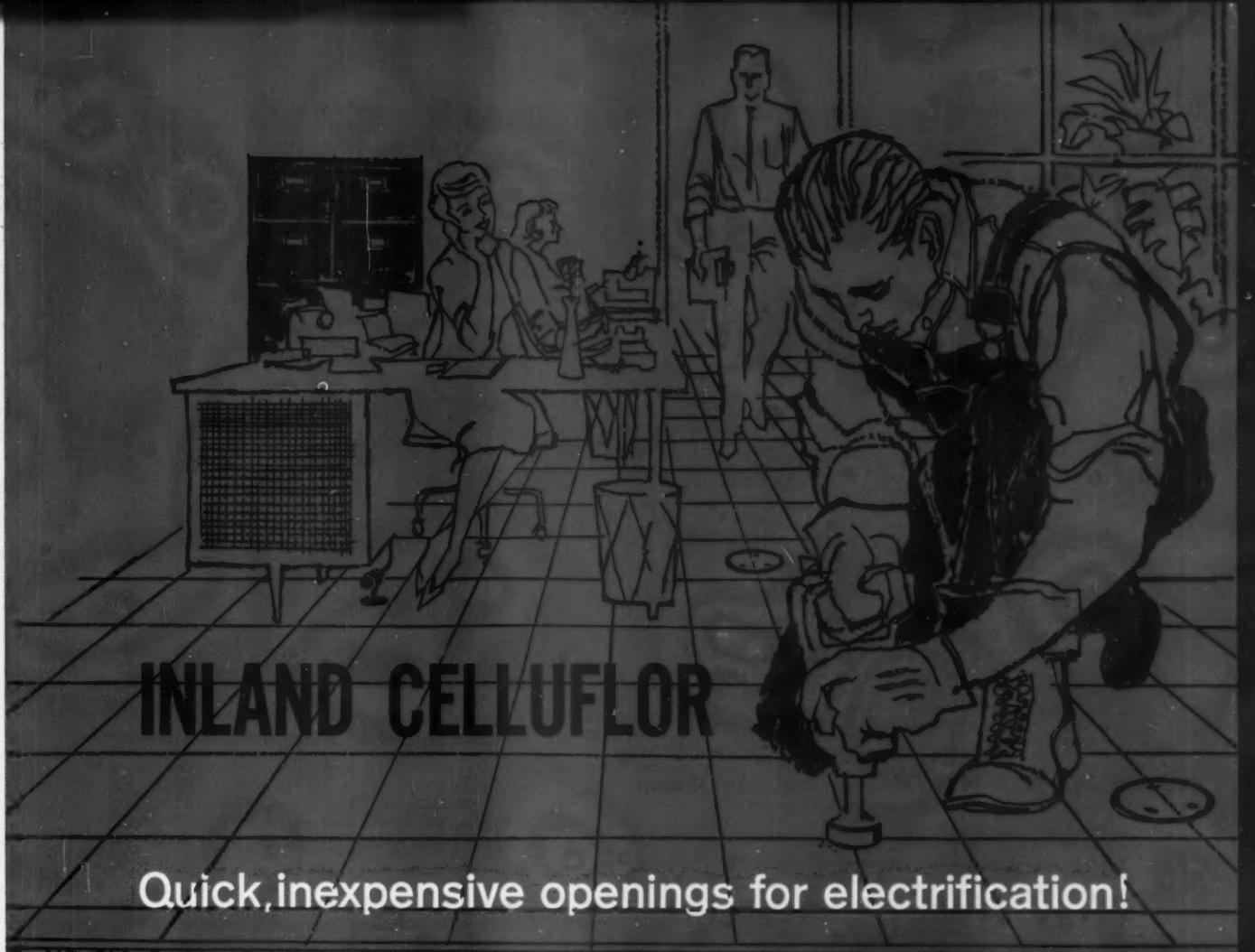
Pumping station for addition to Little Rock Sanitary Sewer System required excavation to depth of 55 feet.

the Fourch Creek drainage basin. Based on their recommendations, a new primary sewage treatment plant with connecting trunks to the existing system was authorized. Total cost of construction was estimated at \$4.5 million.

A site containing approximately 60 acres was acquired adjacent to the Arkansas River. The pumping station required an excavation 55 feet deep in sand and gravel and dewatering was necessary continuously during the seven-month period of construction. A major problem was the interception of the existing 60-in. trunk main which had a cover of 25 to 27 feet. The consultants determined that it was cheaper to lay the new trunk main at this depth than to construct, maintain, and operate two separate pumping stations. This plant is scheduled for operation in April, 1960.

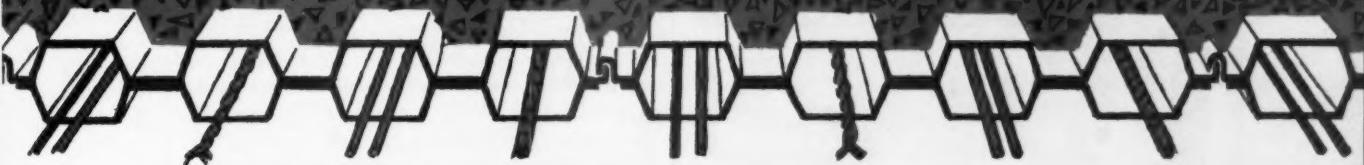
New Hydro-Power Project for USSR

Soviet engineers are now designing a hydro-power station with a capacity of 6 million kilowatts to be built in central Siberia. The site is south of the town of Yeniseysk and downstream from the confluence of the Angara and Yenisey Rivers. A dam about 250-ft high will span the narrow canyon. There will be no spillway and all surplus water will go to the turbines. A single-chamber lock has been designed which will raise ships over 200 feet.



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Quick, inexpensive openings for electrification!



*... whenever you want them, wherever
you want them — with Celluflor*

The typical office interior today is streamlined to the nth degree. Big open work areas — a bare minimum of walls.

Where, then do you put the miles upon miles of wire a modern office building needs now — and the additional miles it's sure to need tomorrow? More and more engineers are reaching this logical conclusion: *In Celluflor*.

Since Celluflor provides wiring raceways 6" o.c. under every square foot of floor area, no worker need ever be more than inches away from electrical, telephone, and dictation service outlets. Whenever a tenant needs a new connection, he has an electrician drill through the floor and pull up the wires — anywhere in the room! Circuits can be changed — new service outlets installed or relocated — without costly alterations.

Many buildings with a future use this floor with a future — including Union Carbide office building, New York City, and Kaiser Center office building, Oakland, California.

There are other advantages of Celluflor — savings of steel, footings, construction time, and overhead. See Sweet's — or write for Catalog 270.



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"C-R" Gaskets may be "snapped on" the pipe at the job site, or pre-assembled by the pipe manufacturer. Available in rubber or neoprene, and specially compounded to resist sewerage and industrial waste acids, they never deteriorate. Write for brochure.

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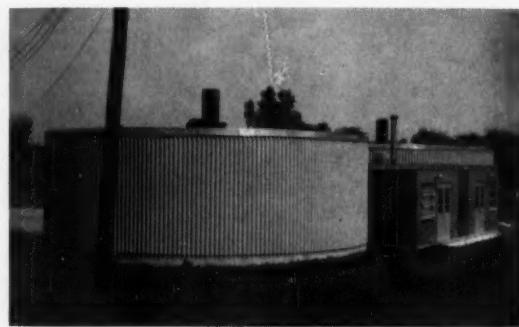
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It is reported that turbines capable of producing 450,000 to 500,000 kilowatts will be used in this project. All construction is to be completed within the next six years.

Sewage Improvement Plan for Perrysburg

A complete sewage improvement plan for the city of Perrysburg, Ohio is now in progress. A sewage treatment plant with sludge digestion facilities for



New digesters for Perrysburg, Ohio, are insulated with fiberglass covered by coated corrugated steel.

11,250 people and four miles of connecting sewers already have been completed. Approximately 11 miles of local sanitary sewers are still under construction. The complete project will cost \$1.2 million. Finkbeiner, Pettis and Strout, Toledo, Ohio, are the consulting engineers who were responsible for the engineering design work.

No pumping of sewage is required at the plant or in the entire system. Sewage from all portions of the village flows to the plant and on through to the Maumee River, entirely by gravity. Primary treatment facilities are provided along with provisions for air mixing, with or without the use of chemicals. Included in the plant units are screening facilities, two primary settling tanks, an aerated grit chamber, air mixing facilities, two primary settling tanks, a parshall flume, two sludge digestion tanks, and sludge drying beds. Chlorination facilities are also provided.

Provision has been made for heating the contents of the two digesters and the digester walls are insulated with 1½-in. fiberglass panels faced with steel sheets. The steel sheets are corrugated, covered with asbestos impregnated with asphalt, and have an exterior surface coating of synthetic resin composition. This comparatively new method of digester insulation compares favorably with earth fills and does not require the extensive maintenance necessary on earth slopes. When compared to brick

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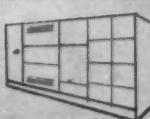
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fusible feeder air circuit breakers.



45 Kva 3-phase transformer with taps.
Interchangeable wall or floor mounting.
Front panel removed, showing interior.



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veneer, the improved insulation more than compensates for the difference in construction cost.

Suspension Bridge in Scotland

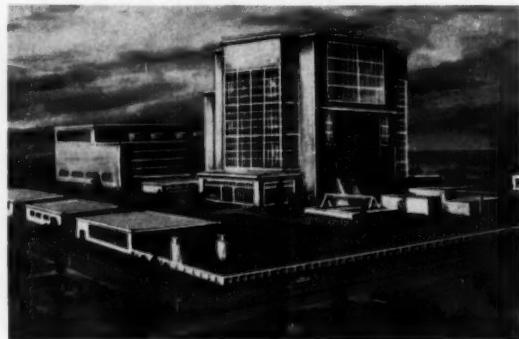
The longest suspension bridge in Europe and the fourth longest in the world was begun last September. It is located on the Firth of Forth about half a mile upstream from the site of the present railroad bridge.

Over-all length of the new three span bridge will be 5980 feet. The two side spans, nearing completion, are each 1340 feet long, and the central span will stretch 3300 feet. Each of the two supporting cables will consist of 12,000 steel wires, one fifth of an inch in diameter, making up a total thickness of two feet. Together, they will be capable of resisting a tensile force of 14,000 tons. The bridge itself will include two 24-ft wide motorways, two 9-ft cycle tracks, and two 6-ft sidewalks. The completed bridge will have an estimated cost of about \$42 million.

Japanese Atomic Plant

An improved version of the Calder Hall atomic energy reactor will be installed by late 1962 at Tokai, Japan, it has been announced by the Japan Atomic Energy Generating Company. Design and construction will be done by the Gerald Electronics

Company of England. Preliminary plans indicate a capacity of 166,000 kilowatts, requiring 185 tons of natural uranium. Fifteen hundred tons of lead



Artist's conception of proposed Calder Hall type atomic reactor for installation at Tokai, Japan.

will be used for control purposes. The building will contain almost 32,000 square feet and will be 138 feet high, with heavy concrete being the primary structural material. Construction of the building will be started as soon as the government gives its final approval.

Shopping Mall for Glen Cove

Following the lead of Kalamazoo, Toledo, and other progressive communities, the city of Glen Cove, New York, is planning to create a traffic-free shopping mall in the heart of its downtown business district. According to Mayor Joseph A. Suozzi, the plan was undertaken through an interest free loan provided by the Community Facilities Division of the House and Home Finance Agency of the Federal government. The purpose of this agency is to assist communities in planning for their future needs.

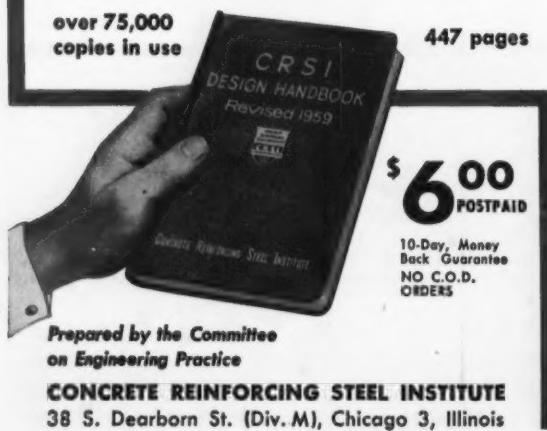
The plan, prepared by Lockwood, Kessler & Bartlett, Inc., consulting engineers of Syosset, New York, calls for the closing of one block on each of four streets radiating from a main downtown intersection. Basic ideas embodied in a preliminary report submitted in October, 1958 are incorporated with a few minor exceptions. Major considerations were traffic routing and parking facilities. The mayor said that many of the recommendations of the Downtown Property Owners Committee were included in the plan. He could not estimate when the city would begin to implement the project as such action will involve coordination, assistance, and cooperation with the County of Nassau. "Each step taken," he said, "is a move forward in our ef-

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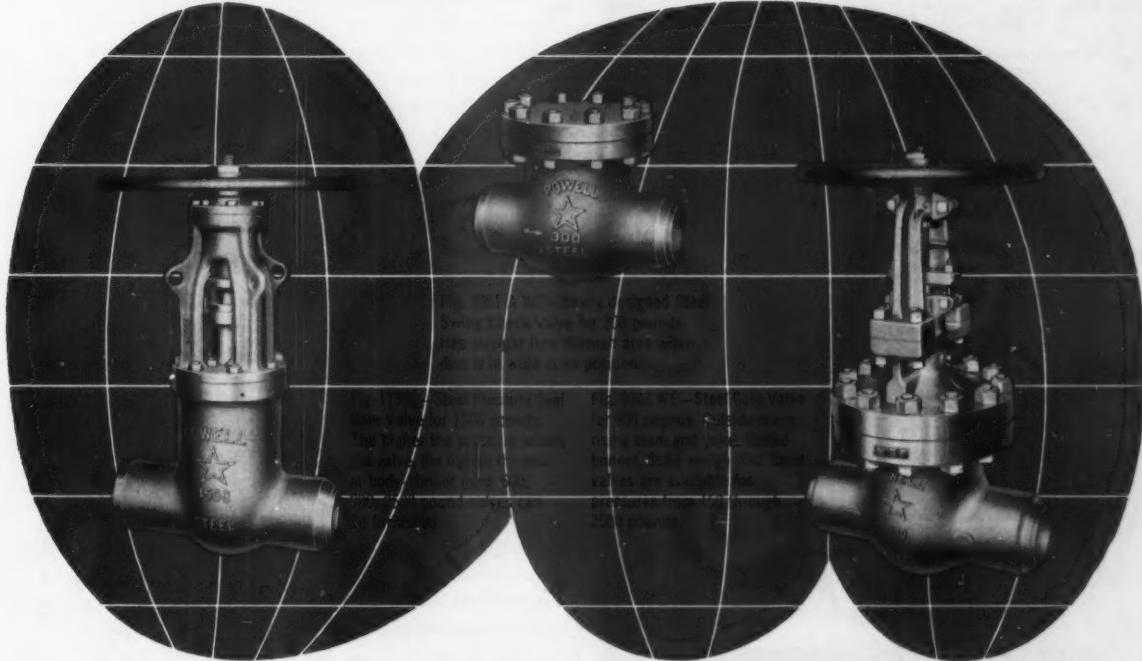
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fort to compete with shopping centers and to bring more business to Glen Cove — something that will benefit all our citizens."

Louisville Suburb to be "Showcase Community"

Watterson City, the largest urban land development of its kind in Kentucky, has been announced by Robert Hensley, president of the newly formed Watterson City, Inc. An over-all investment of more than \$50 million is planned.

The site includes two tracts of land, 55 acres each. It is located in the southeast section of corporate Louisville just 12 minutes from downtown. Named after a revered former editor of *The Courier-Journal*, it is planned to make the community an architectural showcase.

During the summer of 1959, a group of local investors met several times to evaluate different properties as potential development sites. Then, in October, Geer Associates, land planning consultants, of Bloomfield, Michigan, were employed to study the site selected, and the feasibility of the project as a whole. A favorable report was submitted in November and the chartering of the project was undertaken.

In addition to two groups of terraced apartment houses with 155 rental units, the project calls for eight office buildings, none higher than 100 feet;

a luxury motel and restaurant; and a nondenominational chapel. Spacious parking accommodations and recreational facilities such as a golf course, swimming pool, large landscaped areas, and a heliport are to be included. Watterson City, Inc. is presently capitalized at \$1 million.

St. Louis Fire Alarm Center Underground

As a safety precaution, the new St. Louis Fire Alarm Center is located almost entirely underground. A 12-in. thick reinforced concrete roof is covered by 18 inches of earth. The only portion of the building above ground is the southern wall and this could be barricaded in time of crisis.

The new center, when completed next year, will intercept all fire alarms turned in from the city of St. Louis. The alarm, whether received by phone or by fire alarm box, will then be retransmitted to the proper fire station. A total of 1172 miles of underground telephone and telegraph circuits will link all fire stations to the Center, insuring the quickest response to all fire reports.

As in most underground projects, air conditioning is important, and equipment with a capacity of 30 tons was installed in the Center. This insures ideal working conditions for personnel and proper functioning of all equipment. The air conditioning system recirculates inside air or draws it from the outside of the building, depending on outside temperatures. Should the outside air become contaminated by dust or smoke resulting from atomic explosion or other disaster, air circulation is automatically changed.

In addition, two air compressors are used in this installation for pressurizing the communication cables. One unit operates on the lines, with the other as standby. This method insures protection from water seepage and contamination in the event of a mechanical break. It also serves to activate an automatic alarm and "spotting system" if such a break occurs. Engineering consultant for the Center was John D. Falvey, of St. Louis.

New Pennsylvania Toll Road Tunnels?

An engineering report received by the Pennsylvania Turnpike Commission from the consulting firm of Michael Baker Jr., Inc., calls for the construction of two additional tunnels to end traffic jams on the original section of the superhighway between Donegal and Bedford. Cost of the tunnels would be approximately \$20 million, reportedly less expensive than the building of new routes over the mountains which the present tunnels penetrate. The proposed new tunnels would be built alongside the present Laurel and Allegheny tunnels. The consultant's report has been referred to the Turnpike Commission's engineering staff for expedited analysis. □

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Comparative shear strength (1/8" bearing—100%)	100%	15%	177%
Tensile strength	70,000 lbs.	90,000 to 120,000 lbs.	90,000 to 120,000 lbs.
Resistance to slippage	good	fair	excellent
Resistance to vibration	good	good	excellent
Men required to install	one	two	one
Equipment required	sledge and hand wrench	impacter and hand wrench	maul and impact wrench
Installation cost	equal to or less than rivets	less than rivets	less than rivets
Washers required	none	two	one

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The new Lamson High Strength Bearing Bolt is available now through 20 U. S. Steel Supply Division Steel Service Centers in key locations throughout the country.

Write Lamson & Sessions for Bulletin HSBB. Contains pertinent engineering data. Firm names, and locations where these bolts have been used, will be mailed promptly on request.

*Pat. App. for
†Cost based on using bolts with nuts and washers as shown.

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Books

Parallel Reading for
Consulting Engineers

David B. Steinman was born in the shadow of the Brooklyn Bridge and grew up to design another great structure, the Mackinac Bridge. His life has spanned three quarters of a century from the one bridge to the other and he has designed almost 400 bridges in between. *Highways Over Broad Waters*, by William Rattigan, is the story of these years, or better, the story of these bridges.

We follow Steinman through a precocious childhood, hawking newspapers on the bridge he loved, to City College of New York. Never satisfied with any grade less than perfect, his mind absorbed a myriad of subjects. He went on to Columbia, teaching and learning, earning his way with lecturing and scholarships, but always with engineering in his mind. His eye was always on the bridge. In order to secure his PhD he succeeded in having D. Van Nostrand publish his first book and, incidentally, his thesis, *Suspension Bridges and Cantilevers*.

When he was 25, he established a working relationship with Gustave Lindenthal, then the dean of American bridge builders. Soon the design of his first two bridges were under way. These were the Hell Gate Bridge over the East River and the Sciotoville Bridge over the Ohio. It was during this period that he realized the value of "financial engineering" and he developed the understanding of finance that enabled him to talk so convincingly to bankers.

After World War I, bridge engineering had a slight decline and again Steinman supplemented his income by teaching. Along with the regular courses in engineering subjects, he started the first course in Aeronautics ever taught in the U.S. His interest in this subject was to prove of great value later in developing his theory of aerodynamic principles as applied to suspension bridges. His Mackinac Bridge is the first bridge which has a critical wind velocity of *infinity*. Shortly after this teaching period, he set up the partnership which has lasted throughout his professional life. Holton D. Robinson was the other principal and their first job was the Florianapolis Bridge in Brazil.

Over the years many more bridges were to come from his drawing boards. His interest in the profession developed into an obsession and he was one of the leaders in establishing registration. He wrote the registration law for New York State which is the accepted model today. He continued to write and lecture, he edited engineering magazines and held office in practically all the civil engineering societies. Steinman is credited with over 500 technical articles and books. One of his proudest achievements outside of the field of engineering is his book about the Roeblings and the Brooklyn Bridge called *The Builders of the Bridge*.

A list of his patents and hobbies reveals the scope of his mind and his many nonengineering honors reveal the concentration he gives



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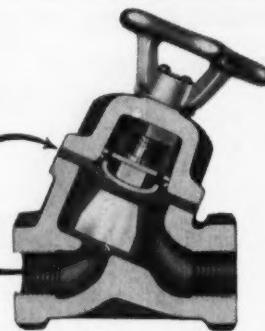
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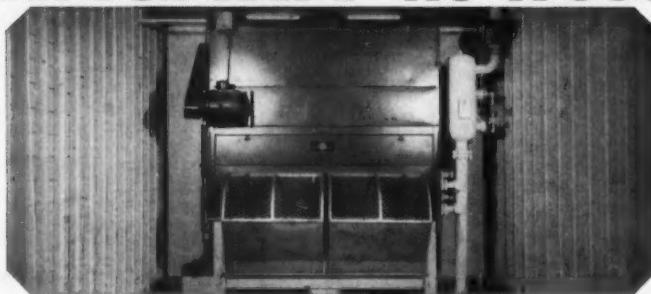


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to his avocations. Steinman's patents on Stereo photography were sold to Hollywood and his color photographs have received many prizes. But the diversion which has absorbed him for the last few years is poetry.

Highways Over Broad Waters is not a good book in the literary sense and the writing is trite and in some places downright careless. However, the research is adequate and the detail on the various bridge stories is of interest to the student and the engineer. But the real Steinman never does come through. There is a good story here for the right man to tell. Perhaps Steinman himself will take the time to do it.

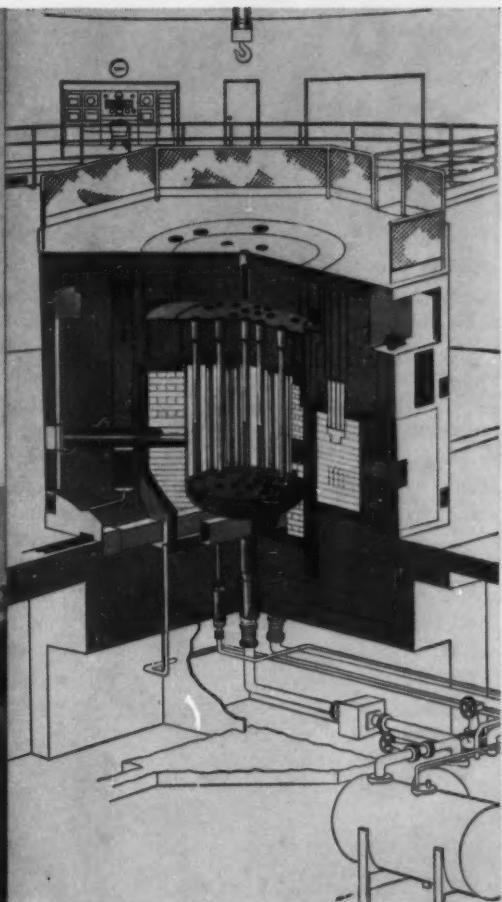
Books Reviewed in This Issue

Highways Over Broad Waters, Life and Times of David B. Steinman, Bridgebuilder, by William Ratigan; William B. Eerdmans Publishing Co., Grand Rapids, Mich.; \$6.00.

New Technical Books

INTRODUCTION TO ELECTRIC CIRCUITS, by Herbert W. Jackson; Prentice-Hall, Inc., New York; \$8.75. This is an excellent home study book for the engineer who desires to brush up on his basic electronics or the student who needs additional help outside of his regular classroom lectures. Much space is devoted to developing the fundamental ideas step by step. The reader progresses from the simple to the more complex, each step based on a preceding step even to the extent of sometimes calling attention to the obvious. In addition, each basic idea is examined from the practical standpoint; examples are picked from both the power and communications applications. The questions at the end of each chapter are comprehensive and require the student to think out his answers. They cannot be answered by copying verbatim from the text. A work-

Euratom's first reactor



Designed and built by Allis-Chalmers, CNRN puts atoms to work for peace

Euratom's acquisition of the heavy-water research reactor designed and built by Allis-Chalmers for Italy's Comitato Nazionale per le Ricerche Nucleari is the first step in a billion-dollar, ten-year program designed to speed the development of nuclear power in Europe. This facility demonstrates the far-reaching abilities of Allis-Chalmers in the nuclear reactor field.

Located near Ispra, Italy, this 5000-kw reactor is now leased to Euratom and represents an important step ahead in the development of Atoms for Peace.

Noteworthy features of the CNRN reactor include 20% enriched fuel . . . dual-loop cooling system which permits operation at half power with one loop while

the other is being serviced . . . facilities for isotope production.

Allis-Chalmers was also responsible for technical supervision during construction, installation, pre-operational testing and start-up. The contract was initiated in October of 1956, and the reactor went critical in March of 1959.

The CNRN reactor is another example of Allis-Chalmers unmatched capabilities and resources in the nuclear field. Whether your own plans are at the "talk-about" stage or ready for blueprints and estimates, you should get better acquainted with what Allis-Chalmers can offer. *A new brochure gives complete details. Write Allis-Chalmers, Atomic Energy Division, Milwaukee 1, Wisconsin.*

OTHER ALLIS-CHALMERS REACTOR PROJECTS INCLUDE: MIT research reactor • Test and research reactors for Sweden and the Netherlands • Radiation effects reactor for USAF • Elk River and Pathfinder boiling water power reactors • experimental gas-cooled reactor for AEC.



A-1207

ing knowledge of algebra is assumed, although a chapter on vector algebra is included.

ELEVATORS, by Fred A. Annet; McGraw-Hill Book Co., 330 West 42nd St., New York, N.Y.; \$11.50. Previously titled *Electric Elevators*, this is the third edition of this standard reference. The subtitle, "Electric and Electrohydraulic Elevators, Escalators, Moving Sidewalks, and Ramps," explains some of the additions. The text has been revised and new subjects have been added to bring it up to date and to comply with the 1955 American Standard Safety Code for Elevators, Dumbwaiters, and Escalators.

A new Chapter 1, combining the old Chapters 1 and 3, gives a broad and comprehensive understanding of dc and ac powered elevators. Old Chapter 2, dealing with double-deck elevators and two elevators operating in one hoistway, has been omitted. Old Chapters 6 on dc brakes and 7 on ac brakes have

been rewritten into Chapter 4 and a new chapter on dc controls for ac elevator motors has been added. Another new chapter discusses automatic elevators, dispatched according to the daily traffic pattern, as in busy office buildings.

In Chapter 11 covering door operators, new material has been added on freight elevators. Chapter 12 includes new material on signal systems that show the waiting passengers where the cars are and the direction in which they are moving. Hydraulic elevators and lifts and their electric controls are in another new chapter. The construction, operation, and control of escalators is covered in a separate chapter. In all, almost one-half of the book is new material. The author is a contributing editor for *Power* magazine.

STANDARD PLANT OPERATOR'S QUESTIONS AND ANSWERS, by Steve Elonka and Joseph F. Robinson; McGraw-Hill Book Co., New York,

N.Y.; Two Volumes, \$8.00 each; \$14.95, per set. The primary purpose of these two books is to provide an up-to-date review course for plant engineers, enabling them to pass the required license examination wherever they may be. Chapter 20, for example, covers stationary and marine requirements for every part of the United States and Canada. The book is also written for consulting engineers, contractors, architects, in fact, anyone having to do with boilers, heat exchangers, or boiler plant operation.

It covers 17 modern types of industrial, utility, and building power equipment, showing their over-all design, component parts, their operation and maintenance, and the design and operation of their auxiliary equipment. Detailed information on such advanced subjects as electronic instruments and control devices, gas turbines, and nuclear power plants is included.

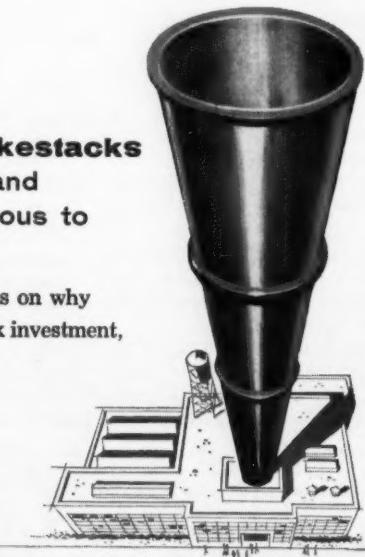
THE DESIGN OF PHYSICS RESEARCH LABORATORIES, by The Institute of Physics (London); Reinhold Publishing Corp., New York; \$4.50. Research is the Cinderella of today's corporate structure. And management would do well to recognize that its research facilities, many of which began during World War II, need constant reappraisal. A projection of the growth pattern for 20 or 30 years into the future is essential to the continued value of present facilities. Certain trends are being clearly established. For example, separating research and manufacturing sites. Also, cheaper sites in the country offer many advantages. Modular planning with the specific research worker in mind is another healthy trend. Problems of waste disposal, especially in atomic work, must also be considered.

This book is a collection of the proceedings at a symposium held recently at the Institute of Physics in London. It is primarily concerned with physics laboratories, but much of the material is of



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a general nature and would apply to the design of any science research facility.

ECONOMIC CONTROL OF INTERCONNECTED SYSTEMS, by Leon K. Kirchmayer; John Wiley & Sons, Inc., New York; \$12.50. Designed as a companion volume to the author's earlier book, *Economic Operation of Power Systems* (Wiley, 1958), this book is a treatment of means and methods to obtain optimum economic operation of interconnected electric utility systems. Its complete dependence on the first book is a major fault. Also, any consultant who is looking for data on the use of Diakoptics, as is promised in the publisher's blurb, is sent once again to the reference shelves. However, with adequate reference material available, this is a competent text for use as a course in systems engineering at a graduate level, which was its original intent. It is another in the excel-

lent series of technical books written by General Electric authors for the advancement of engineering practice.

DEFENSE R & D CONTRACTS GUIDE, edited by Lt. Col. Jesse L. Lewis, USA, Retired; Vincent F. Callahan, 1420 New York Ave., Washington 5, D. C.; \$25.00. This guide is primarily a directory for defense research and development. It is claimed to be the only book of its kind and certainly contains a great amount of specialized information not available elsewhere. The publishers also circulate the *Defense R & D Contracts Report*, among others. This is a weekly service on how and where to obtain military research and development contracts and costs \$90 a year. Considering that so much of this material is narrow in scope and transitory, consultants who are interested in this field should investigate all the publications from this source to determine which

one would be most applicable to his individual needs. For example, two other newsletters offered are *Missile and Space Contracts Report* and *The Renegotiation Letter*.

MANUAL OF DUCT CONSTRUCTION; published by the Sheet Metal and Air Conditioning Contractors' National Association, Inc., 107 Center St., Elgin, Ill.; \$5.00. A handbook for the sheet metal construction of ducts for heating and air conditioning systems, this manual is written primarily for the contractor. Construction methods and techniques, materials available and how used, typical problems and their solutions are some of the subjects covered. No specific engineering data is included such as that required for determining static pressures, velocities, and material selection. However, the consultant who is concerned with specifying in this field will find this a valuable reference.

MODERN MASONRY: NATURAL STONE AND CLAY PRODUCTS, published by the Building Research Institute; National Academy of Science, 2101 Constitution Ave., Washington, D. C.; \$4.50. This is a comprehensive volume on the technology of building with masonry. Included are the latest technical developments, comparative cost analyses, maintenance requirements, and recommended design features. Buildings discussed are homes, multistory buildings, and institutional types.

PLASTIC IN BUILDING, published by the Building Research Institute; National Academy of Science, 2101 Constitution Ave., Washington, D. C.; \$5.00. The past and present uses of plastics in building are presented here in a factual and well illustrated report. The potential of these materials, along with specific applications such as their use for glazing, thermal insulation, piping, and ducts is developed at length. There is also a discussion

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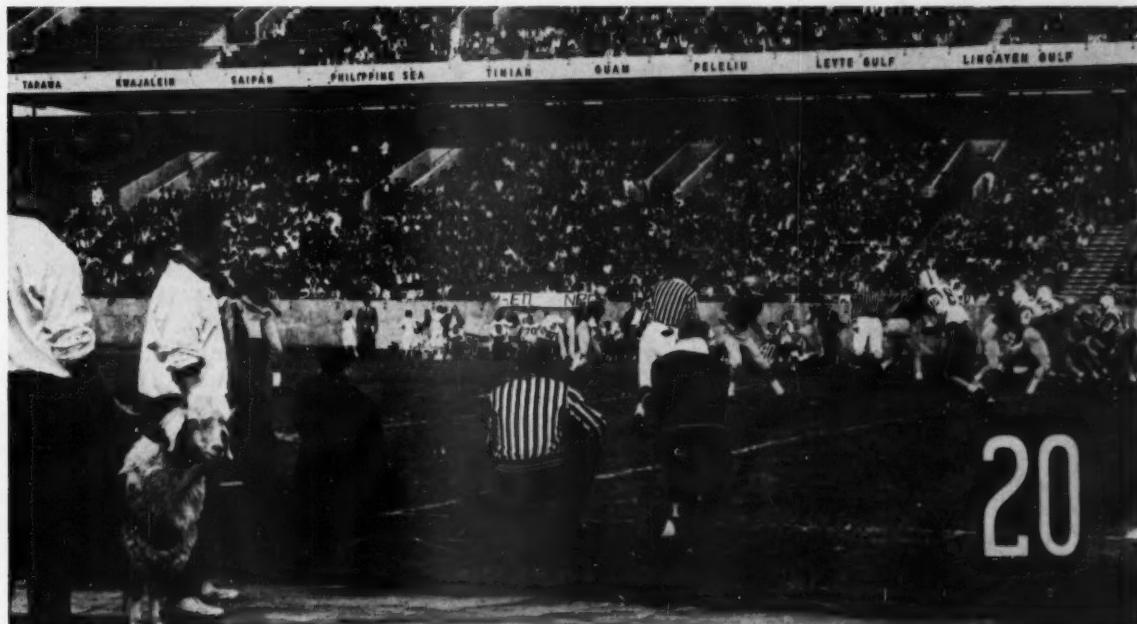
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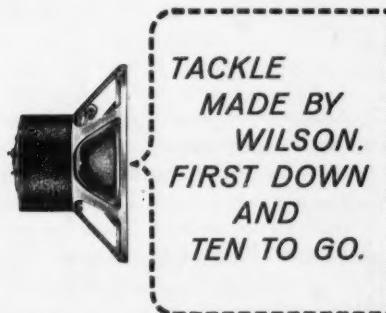
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of standards and codes for plastic building products and materials.

METAL LATH SPECIFICATIONS; Metal Lath Manufacturers Association, Engineers Building, Cleveland, Ohio; Free. This standard reference booklet contains fire resistance ratings, design tables, and specifications for hollow partitions, solid partitions, sound insulating partitions, ceilings, vertical furring, and centering. All phases of metal lath construction are covered.

FUNDAMENTALS OF BUILDING INSULATION; Insulation Board Institute, 111 West Washington St., Chicago 2, Ill.; Free. This 44-page booklet is compiled for engineers, architects, students, and contractors who are engaged in the construction industry. It is published annually by the Institute to keep the industry informed of significant developments in insulation design and application. Single copies are free, and up to 30 copies are free for

schools and colleges where the booklet will be used by classes in building construction.

MECHANICAL JOINING OF ALUMINUM, published by the Reynolds Aluminum Company, Dept. PRD-28, Richmond, Va.; Free. A well-illustrated, 32-page booklet, just published by the Reynolds Aluminum Co., this handy reference can be obtained free by requesting it on your letterhead. It covers all methods of mechanically joining aluminum such as nails and pins, metal stitching, mechanically formed joints, and architectural fasteners.

FERRITES, by J. Smit and H. P. J. Wijn; John Wiley & Sons, New York; \$10. This book is intended for all those who are interested in the properties of ferromagnetic oxides. The term ferrites is used to refer to all magnetic oxides containing iron as the major metallic component. Those characteristics of importance for application pur-

poses are discussed and, wherever possible, explained in terms of intrinsic properties. These properties then are related to the chemical composition and crystalline structure of the material.

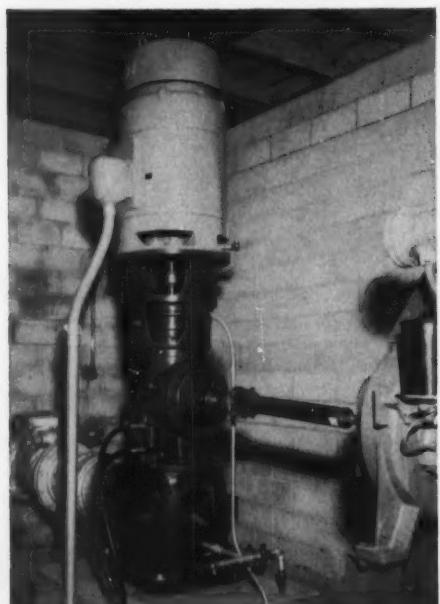
The book is well organized and anyone with special interests can readily find the particular chapter that applies. The c.g.s. system of units is employed, that is, the various parameters are expressed in terms of cm, ampere, volt, oersted, gauss, and erg.

Both of the authors are employed as Research Physicists at the Philips Research Laboratories in Eindhoven, Netherlands, and most of the material is based on their experiments there.

Films

MIRACLE BRIDGE OVER MACKINAC (16 mm, sound film); Association Films, Inc., Ridgefield, N. J. (Broad at Elm); LaGrange, Ill. (561 Hillgrove Ave.); Dallas, Texas (1108 Jackson St.); and San Francisco, Calif. (799 Stevenson St.); Free (loan basis). This 28½-minute sound film in color shows the building of the five-mile-long Mackinac Bridge which unites Michigan's upper and lower peninsulas. The film, narrated by John Cameron Swayze, describes how piers were built as deep as 215 feet underwater despite the strong currents and high winds. Scenes show construction crews racing against time to complete the 34-pier substructure before winter sets in. It is presented by Merrit, Chapman and Scott and is available for community organizations and TV stations.

"LOW COST CONCRETE HIGHWAYS WITH THE SLIP-FORM PAVER," (sound and color; 16 mm; 12 min.). This film shows how a concrete pavement is placed with the latest slip-form equipment — from grading and placement to the curing and sawing of joints. It is available through all district offices of the Portland Cement Association. ▲



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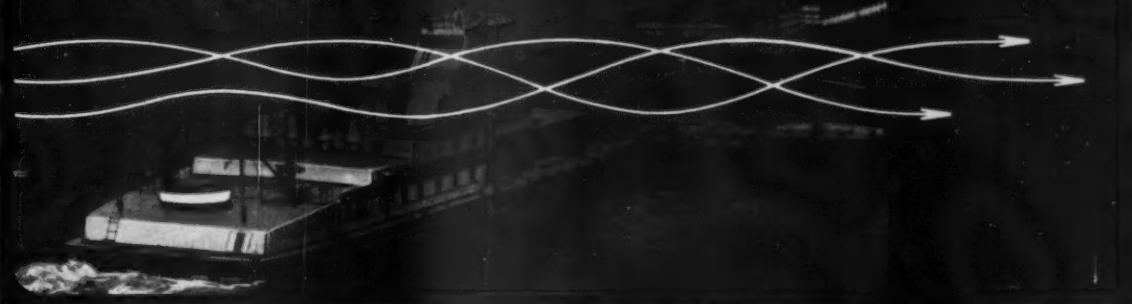


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Consulting Engineers' Calendar

Feb. 9. Association of Consulting Chemists & Chemical Engineers, Inc.; Luncheon Meeting, Hotel Shelburne, New York, N. Y.

Feb. 10. American Water Works Association (New Jersey Section); Winter Luncheon Meeting, Hotel Essex House, Newark, New Jersey.

Feb. 11-12. University of Mississippi; Sixth Annual Mississippi Highway Conference, Campus.

Feb. 18-20. National Society of Professional Engineers; Winter Meeting, Broadview Hotel, Wichita, Kans.

Feb. 21-24. American Institute of Chemical Engineers; National Meeting, Hotel Biltmore, Atlanta, Ga.

March 6-9. American Society of Mechanical Engineers; Gas Turbine Power and Hydraulic Conference, Rice Hotel, Houston, Texas.

March 7-8. University of Florida, Mechanical Engineering Department; Annual Heat Transfer Symposium, Room 512, Engineering and Industries Building.

March 7-11. American Society of Civil Engineers; New Orleans Convention, Jung Hotel, New Orleans, La.

March 14-17. American Concrete Institute; 56th Annual Convention and Exhibit, Commodore Hotel, New York, N. Y.

March 15-17. National Association of Corrosion Engineers; 1960 Corrosion Show and Annual Conference, Dallas, Texas.

March 23-26. Electrical Maintenance Engineers Association of Southern

California; Electrical Industry Show and Lighting Exposition, Shrine Exposition Hall, Los Angeles, Calif.

April 3-8. Engineers Joint Council and Instrument Society of America; Sixth Nuclear Congress, New York, N. Y.

April 18. The Producers' Council; Spring Meeting and Board Meeting, Mark Hopkins Hotel, San Francisco, California.

April 18-19. American Society of Mechanical Engineers, Institute of Radio Engineers, and American Institute of Electrical Engineers; Third Annual Conference on Automatic Techniques, Cleveland-Sheraton Hotel, Cleveland, Ohio.

April 19-21. Building Research Institute; Spring Conference, Statler Hilton Hotel, New York, N. Y.

April 27-30. Western Air Conditioning Industries Association; 3rd Western Air Conditioning, Heating, & Refrigeration Exhibit & Conference, Shrine Exposition Hall, Los Angeles, Calif.

May 15-20. American Water Works Association; Annual Conference, Bal Harbour, Florida.

May 23-26. American Society of Mechanical Engineers; Design Engineering Conference and Show, Statler Hilton, New York, New York.

June 5-10. American Society of Mechanical Engineers; Semiannual Meeting and Aviation Conference, Statler Hilton, Dallas, Texas.

June 13-17. American Society of Civil Engineers; Conference on Shear Strength of Cohesive Soils, University of Colorado, Boulder, Colorado.

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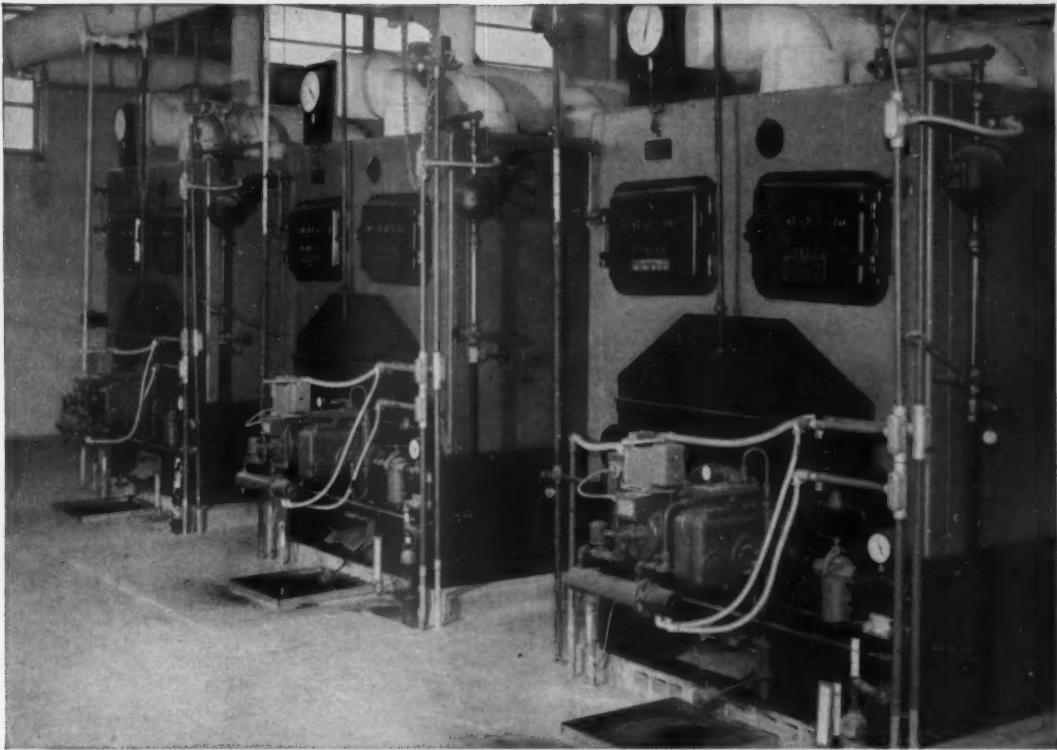
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Independent Tests Show:

Flow characteristics of AMVIT clay pipe permit efficient, lowest cost-in-place sewer design

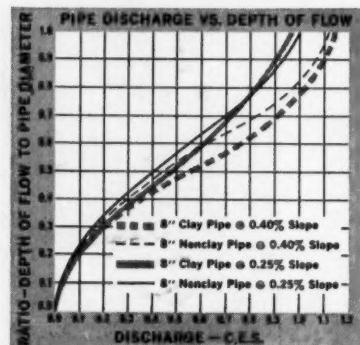
There is no difference in value of Kutter's "n" between different types of pipe materials

There have been many claims and counter-claims dealing with the "n" factor in the Manning approximation of the Kutter formula relating to the flow-coefficient of friction of various types of piping materials.

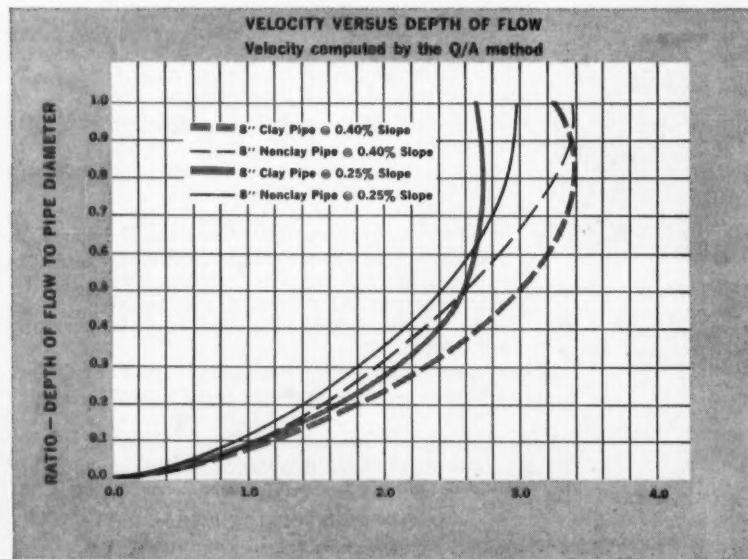
For many years, sewer designers have used the "n" factor of .013 in the design of sanitary sewer systems involving vitrified clay pipe. Recently, the manufacturers of substitute non-clay materials have claimed that the "n" factor for their product is less than .013, usually claiming it is .010.

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This graph shows discharge versus depth of flow.



This graph shows velocity as related to depth of flow.

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COMPANY**

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

In Canada: Rohm & Haas Company of Canada, Ltd., West Hill, Ontario

How much do you know about

TURBOCHARGING AN ENGINE?

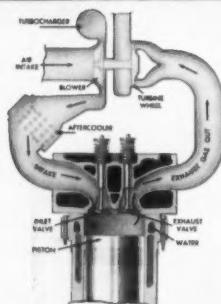
An interview with William M. Kauffmann, Chief Engineer of the Engine Division, Worthington Corporation. Turbocharging of high-output engines is an accomplished fact. Last year 100% of all power engines built by Worthington were equipped with turbochargers. In this short interview Mr. Kauffmann outlines some of the design philosophy behind turbocharging. If you would like to have more information about Worthington's line of turbocharged engines and engine compressors, won't you write to Worthington Corporation, Section 43-7, Harrison, N. J. In Canada: Worthington (Canada) Ltd., Brantford, Ontario.



WORTHINGTON

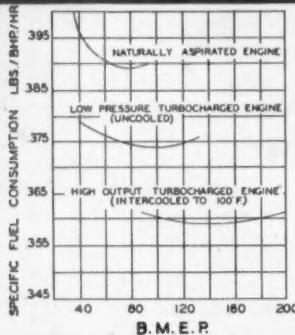
WHAT'S INVOLVED IN HIGH-OUTPUT TURBOCHARGING?

Q.



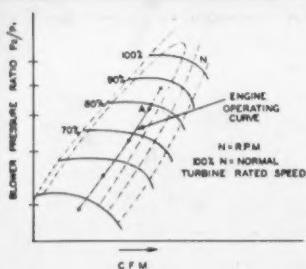
TURBOCHARGING MADE IN FUEL ECONOMY?

Q.



WHAT LEVEL RATINGS ARE POSSIBLE?

Q.

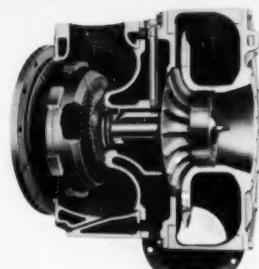


A. The method I favor uses design principles that produce optimum mechanical and thermal operating efficiency. For example, four-valve head design gives higher volumetric efficiency; thru-flow scavenging results in increased cool air flow through the cylinder; flood cooled pistons reduce ring belt temperature; dry exhaust manifold lowers heat rejection to cooling system; air aftercooling reduces initial cycle temperature and thermal load; high pressure turbochargers give high air excess at moderate charging pressures due to improved combined efficiencies of gas turbine and blower; fixed valve overlap assures best scavenging ratio and increased trapped air volume; high velocity jacket water cooling reduces liner temperature.

A. An integrated turbolubricating system permits using proper lubricant for the turbocharger. A separate sump, full-flow filter and pump provide complete rotating element protection for long life with only periodic inspection. These turbochargers are of rugged design and are thoroughly field proven. Normal full load speed is conservative, usually not exceeding 80% of supplier maximum recommendation.

Q. WHAT ABOUT MAINTENANCE AND RELIABILITY?

Q.

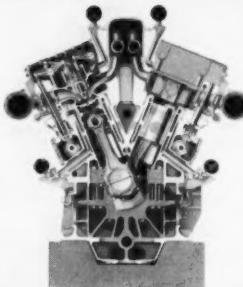


A. Paradoxically, modern high-output Diesels exhibit far better fuel consumption than older, low pressure charged units. Fuel consumptions of .360 lbs./bhp/hr. or lower, on fuel oil, and 6250 Btu/bhp/hr. or under, on dual fuel or spark ignition operation are not unusual. This makes thermal efficiencies of 40% or over, available to power users. Result: additional first cost economy for heat exchanger equipment and auxiliary sizes, plus the better plant economy.

A. The first turbocharged gas burning diesel was conceived by Worthington's engineers in 1943, and demonstrated to the public early in 1945. This design used low pressure gas, admitted into the air inlet passage, and represented a new concept for gas operation. Air-fuel ratio control developments (Worthington's "Turboizer") for spark ignition engines, followed. Since many basic dual fuel and spark ignition engine components were interchangeable, the Tri-Power engine was the next logical step. This gives turbocharged diesel oil, dual fuel gas, or spark ignition gas engine operating with the same unit, allowing use of most economical fuels.

Q. WHAT IS THE SECRET TO DESIGNING A HIGH-SPEED ENGINE?

Q.

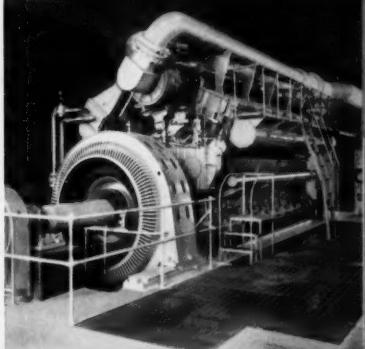


A. Reduced barometric pressure at altitude increases available gas turbine power, thus allowing packing as much air into the engine as at sea level. Turbochargers with blower pressure ratios up to 3.0, make possible sea level ratings at altitudes up to 8000 ft. Turboblower discharge air aftercooling gives these engines low mean cycle temperatures consistent with sea level operation. Benefit: less floor space and building size than for previously derated units. Such units have given exceptionally reliable service, matching sea level overload performance.

A. Large bore, slow speed, gas engines suffer from low knock limit due to small cooling area per unit cylinder volume. Here, extreme measures to cool the air are necessary, although possibly complex and costly for moderate ratings. High cylinder surface-to-volume ratio engines (such as Worthington's SW14) exhibit high knock limit and will operate at high bmeep with only normal aftercooling. This means simpler construction and operation.

Q. WHAT COOLING NEEDS EXIST?

Q.



2

Part 2 February 1960

Consulting Engineer

Keep This Directory in Your
Technical Reference File



A DIRECTORY OF
ADVERTISERS' LITERATURE

A Directory of Advertisers' Literature

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DIRECTORY OF ADVERTISERS' LITERATURE

AIR CLEANERS & DUST COLLECTORS



1—Fly Ash Dust Controls

Bulletin V-100 introduces the *Verticone* conditioner for fly ash dust control or for unloading of dusty materials from bins and silos. The *Verticone* also provides first practical means of dust-free unloading of cyclones, bag filters, and electrostatic precipitators. Units available up to 200 tons per hour capacity.

Johnson-March Corp.

7—Industrial Dust Control

Bulletin 800 contains full technical information on industrial dust control and recovery equipment. Five types of dust filters are described in detail — four bag-type collectors, one cyclone type. Complete specifications for each model within each series are included. Photographs illustrate existing dust control systems.

Dracco Division of Fuller Co.



2—Centrifugal Dust Collectors

Improved design of the Norblo High Efficiency Low Static (H.E.L.S.) centrifugal dust collector includes deep body and improved proportions and does away with dampers frequently used to overcome back pressure, according to 4-page bulletin 104-3. Capacities and dimensions are listed.

Northern Blower Co.

8—Dust and Mist Collectors

Bulletin 736 illustrates the entire Aget line and includes complete dimensions and specifications. Forty basic *Dustkop* units will collect everything from wood chips to fine dust particles. Also 4 *Mistkops*, 4 *Filterkops*, 2 *Dustbusters*. Descriptive copy and recommended uses for models. Photographs of installations.

Aget Manufacturing Co.



3—Centrifugal Fans

Bulletin FD-11 describes *Whirlex* Airfoil centrifugal fans. Wide range of standard and optional features are offered. Various arrangements are explained and pictured showing the flexibility of application. All fan ratings based on standard test procedures. Available in Class I through Class IV construction.

Fly Ash Arrestor Corp.

9—Cyclone Dust Collectors

Bulletin C-103 describes design and construction of Buell high-efficiency Cyclones. Features include exclusive "Shave-off" port which traps extra percentage of dust, particularly smaller fines. Fully illustrated. Lists all information necessary for specifying. Covers importance of manifolding.

Buell Engineering Co., Inc.



4—Charcoal Purification Cells

Comprehensive bulletin describes activated charcoal purification cells and how they can save heating and cooling costs by permitting recirculation of air. Installation and construction details, air capacities, and resistances to air flow. Outlines charcoal reactivation services and testing procedures.

Barnebey-Cheney Co.

10—Dust Control Systems

Catalog SJP-1001 describes new *Chem-Jet* dust control systems for suppression of coal dust at rotary car dumpers, car shakeouts, track hoppers, conveyor transfer points, coal crushers, reclaim hoppers, and coal storage piles. Includes description of new Type A Hydro-Precipitator scrubber.

Johnson-March Corp.



5—Dust Collectors

Catalog 359 describes briefly complete line of Torit dust collectors for industry. Current models of both self contained cabinet cloth filter type and cyclone separators are illustrated with dimensions and specifications for each. Installation photographs illustrate all models in use. Accessories are listed.

Torit Manufacturing Co.

11—Bag-Type Dust Collectors

How the *Norblo* automatic bag-type dust collector can provide continuous operation at full capacity is explained in four-page folder 164-5. Dimensions and capacities are listed in tabular form. A flow diagram explains how the unit works. Each part of the collector is shown separately with its description.

Northern Blower Co.



6—Multiple Serving Dust Collector

Dustkop model 30N50P, a one-unit system serving 7 grinders. Where floor space is limited, unit is suspended from ceiling or installed on roof. Pipe is angled from collector to caster-mounted dust drum placed in any unused area. Drum is rolled to outside dumping point and emptied without recirculating dust.

Aget Manufacturing Co.

12—Cloth-Type Dust Collectors

Bulletin 10-27-59 describes the *Roto-Jet* cloth-type dust collector designed by *Dustex* to eliminate usual cloth filter problems. Rotating blow tube and roller support system requires no reversing mechanisms, operates with low torque, prevents cloth jamming. Drawings illustrate operating principles.

Dustex Corp.

AIR CLEANERS & DUST COLLECTORS continued

**13—Air Purifiers**

Bulletin T-264 describes types of equipment available for air purification by the "Black Magic" of activated charcoal. Details and specifications concerning portable purifiers, disposable filters, wall units, heavy duty cells, and cabinet purifiers. Charcoal increases comfort and safety in living and working spaces. *Barnebey-Cheney Co.*

**15—Wet Dust Collector**

Bulletin describes the new *Mist-O-Miser* wet dust collector. This unit is a new concept in wet collection and offers a wide range of construction features and methods of dust disposal. Cutaway photograph shows construction and line drawing shows principle of operation. Arrangements described and illustrated. *Fly Ash Arrestor Corp.*

**14—Cyclone Dust Separators**

Bulletin sheets describe several models of cyclone dust separators, contain photographs of actual installations, multiple rating tables, specifications, floor space requirements, and dimensional drawings. Sheets are printed in two colors. Explain the use of after-filter where air is to be recirculated. *Torit Manufacturing Co.*

**16—Cyclone Dust Collectors**

Bulletin 10-26-59 describes Dustex cyclone dust collectors for product recovery and dust nuisance elimination where ultra-high *Miniature* efficiencies are not required. Cutaway with captions pictures operating principles. Graph shows pressure drop across collector. Dimensions of various models. *Dustex Corp.*

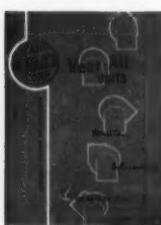
AIR CONDITIONING & REFRIGERATION

**17—Cooling Towers**

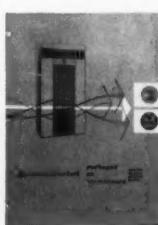
Acme *Econ-o-Mizer* cooling tower line, offering more capacity per pound per square foot, easier installation and maintenance, is fully described and illustrated in Catalog 362. Includes complete specifications, dimensional drawings, and capacity (20-120 tons) data for all nine models. *Acme Industries, Inc.*

**20—Dual Duct Air Mixing Units**

Bulletin DD-6 describes dual duct air mixing units for high and low velocity systems. Detailed information includes blue prints showing different arrangements for same space, cross-section diagrams, dimensions, performance data, and complete specifications. Installation and product photographs are shown. *Buensod-Stacey, Inc.*

**18—Centrifugal Blowers**

Catalog 236 describes Master Fan's self contained, compact, belt driven, and direct connected centrifugal blowers. Gives performance tables and dimensions of both forward curve and backward curve types. All are heavy duty, Class 1 construction and are available with a wide variety of optional features. *Master Fan Corp.*

**21—Packaged Air Conditioners**

Bulletin 8525 describes American-Standard's packaged air conditioners in sizes and types for every air conditioning need. Photograph with keyed captions show various components. Complete specifications for each model, both air cooled and water cooled. Drawings show layouts for single rooms and entire buildings. *American-Standard, Industrial Division.*

**19—Water and Refrigerant Coils**

Catalog 5559 contains a full description of a complete line of water and direct expansion refrigerant coils. The catalog describes exclusive construction features with physical and performance data. Piping diagrams, architectural and engineering specifications, and many illustrations are included. *Young Radiator Co.*

**22—Air Conditioners, Refrigerators**

Bulletin RS2D covers the entire line of air conditioning and refrigeration products. Range of sizes, specifications, and general description is given for each item. Items covered are packaged air conditioners (air and water cooled), packaged liquid chillers, room air conditioning coils, and others. *Curtis Manufacturing Co.*

DIRECTORY OF ADVERTISERS' LITERATURE

AIR CONDITIONING & REFRIGERATION continued



23—Curtain Air Conditioners

An eight-page booklet of architect sketches showing different applications of the Lennox Comfort Curtain system for heating, ventilating, and air conditioning classrooms. An attractive two-color booklet, this brochure shows heater rooms and heating equipment integrated into the design of schools and libraries.

Lennox Industries Inc.



24—Year-Round Air Conditioners

New publication 11-2 features the "Nesbitt Year-Round Syncretizer," an air conditioner that sets a new standard of classroom comfort in schools and colleges. Colorful, 16-page catalog describes the operation of the cost-saving Nesbitt year-round heating, ventilating, and air conditioning system.

John J. Nesbitt, Inc.



25—Hermetic Compressors

New 24-page catalog 6GL-21 contains descriptive and engineering information on 5 to 150 ton hermetic compressors and condensing units for air conditioning and refrigeration applications. Complete capacity ratings, specifications, dimensions, and selection data are included to facilitate design and installation.

Carrier Corp.



26—Coil-Type Spray Dehumidifiers

Bulletin 37 gives complete information on Marlo coil type spray dehumidifiers for washing, cleaning, humidifying, dehumidifying, heating and cooling, available in 327 sizes, air volumes from 600 to 76,000 cfm. Bulletin includes design specifications, dimensional data, and engineering data.

Marlo Coil Co.



27—Motorless Valve Attenuator

Bulletin K-45 describes the new Connor Kno-Draft Series 45P valve attenuator, which uses no motors or linkage of any kind, and is designed for use in dual duct high velocity air distribution systems. Features are listed, function explained and diagrammed, performance data, and dimensions.

Connor Engineering Corp.



28—Control Guide for Engineers

Barber-Colman Company of Rockford, Illinois, has published an Automatic Control Systems Guide, F-8944, for consulting engineers. The guide discusses Electronic control systems and a selection guide for designing various types of automatic systems for air conditioning, heating, and ventilating.

Barber-Colman Co.



29—Air Conditioning Data File

A new high velocity data file is designed to help the air conditioning industry utilize the advantages of high velocity air transmission and distribution. It discusses what high velocity is, what it can do, and where it should be used, duct design, duct construction, and temperature control.

Barber-Colman Co.



30—Applied Machinery and Systems

Catalog LL-349 covers in detail the many products for industrial and commercial air conditioning manufactured by Chrysler Airtemp Applied Machinery and Systems Department. Includes data and ratings on packaged chillers, large central station packaged air conditioners, and air handling units.

Chrysler Corp., Airtemp Division.



31—Hi-I Induction Conditioners

Catalog MS-115 features the York Hi-I induction conditioners for multi-room buildings, in which both cold and warm water are always available to provide either heating or cooling. Styles, features, specifications, dimensional data, performance data, and rating tables. Installation photographs included.

York Corp.



32—Refrigeration Condensers

Engineering data on a complete range of sizes and types of condensers for ammonia and Freon refrigerants are given in 40-page bulletin RC-2, "Refrigeration Condensers." Closed, horizontal multi-pass types, and open, vertical single-pass types are featured. Piping sizes and temperature tables also are included.

Henry Vogt Machine Co.



33—Multi-Zone Air Conditioning

First complete reference data on design and layout for multi-zone installation practice. Text, 24 pages, covers construction details, design procedures, basic air distributing schemes, air handling apparatus, budget costs, automatic control, winter and intermediate operation, specifications. Valuable for the designer.

Buensod-Stacey, Inc.



34—Central Air Conditioners

New bulletin AC-121 gives complete data on "Buffalo" Model G central station air conditioning cabinets. Type PC for horizontal floor or ceiling installation, type UPC for vertical operation, type PCW spray coil for horizontal operation, type VPCW spray coil for vertical operation. Details on performance data.

Buffalo Forge Co.

AIR CONDITIONING & REFRIGERATION continued

**35—Packaged Liquid Chillers**

Bulletin R4C covers a new line of packaged liquid chillers with multiple cylinder hermetic compressors. Chillers are available in sizes 10 tons thru 100 tons. All units are shipped completely assembled and are factory engineered and tested before shipment to insure proper performance. Tables of capacities.

Curtis Manufacturing Co.

**41—Control Performance Test Report**

Barber-Colman Company of Rockford, Illinois, has issued a performance test report on an electric unit ventilator controls installation in Zion, Illinois. The 14-page report tells of advantages gained through ratio room and discharge control for accurate control of room temperature. Photographs and charts.

Barber-Colman Co.

**36—Evaporative Condensers**

Bulletin 50 describes line of Marlo evaporative condensers, in three types — horizontal, vertical, low silhouette — 20 sizes, capacities 3 to 250 tons. Bulletin includes photographs, drawings, construction features, performance charts, ratings, and specifications. Additional data also is included in this 24-page bulletin.

Marlo Coil Co.

**42—Air-Cooled Condensers**

Bulletin F-4095 gives complete data on a new line of low silhouette units which eliminate problems common to other air-cooled condenser designs. Shipped as factory assembled packages. Vertical discharge gives accurate control regardless of wind. Unique by-pass damper head pressure control.

Buffalo Forge Co.

**37—Central Plant Air Conditioners**

Engineering catalog with illustrative and descriptive information and complete selection data on central plant conditioners, multizone conditioners, sprayed coil units, heating-ventilating units, cooling and heating coils. This catalog is notebook type and is index tabbed for easy and quick use.

Thermal Engineering Corp.

**43—Water Chillers**

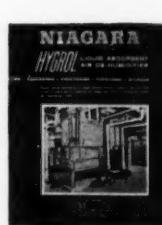
Catalog EM-235 describes the York lithium bromide absorption system which automatically chills water for air conditioning and process refrigeration. A diagram in six colors, one for each element, shows how the system works and the relative position of the various elements comprising the system.

York Corp., Sub. of Borg-Warner Corp.

**38—Steam Humidifiers**

"Humidification for Profit", 16-page bulletin 5001, gives data showing how relative humidity affects hygroscopic materials, health and comfort, and formation of static electricity. Schematic diagrams and sectional drawings demonstrate operation of electric and air-operated steam humidifiers.

Armstrong Machine Works.

**44—Air Conditioner-Dehumidifier**

Bulletin 140 describes means of precise manipulation of humidity and temperature, air-conditioning critical processes of drying, and holding heat-sensitive materials, using absorbent liquid to dry air at moderate temperature without refrigeration. Diagrams, photos, chart of dehumidification, units up to 20,500 cfm.

Niagara Blower Co.

**39—Cold Plates and Snow Pans**

Bulletin 863 gives data and specifications on Dean cold plates and snow pans for food service display and preservation. Promotes food sales by keeping food absolutely sanitary at all times. No cracked ice. Easily cleaned. Shows how to do your own estimating. Beautifully printed in four colors.

Dean Products, Inc.

**45—Auditorium Air Conditioner**

Publication 22-1 completely describes the Nesbitt AudiCon for quiet operation in school auditoriums, libraries, cafeterias, and administration areas. Sixteen models available — 1250 to 15,000 cfm — 3 to 60 tons cooling capacity — 40,000 to 1,500,000 Btu/hr heating capacity. Cutaways and photographs.

John J. Nesbitt, Inc.

**40—Radial Compressors**

Catalog ME-123, completely revised, describes the exclusive time-proven Chrysler Airtemp radial compressor and condensing units built in 10 hp to 125 hp sizes for air conditioning and refrigeration. Includes all information necessary for selection and application — capacity ratings, engineering specifications.

Chrysler Corp., Airtemp Division.

**46—Uni-Flo Condensed Catalog**

Uni-Flo air distribution equipment is highlighted in a new condensed catalog F-4471-6. Sidewall, ceiling and floor diffusers, high velocity equipment, and Uni-Flo accessories are illustrated in this new catalog. Line drawings show dimensions of units. Specifications, general and for specific models, given.

Barber-Colman Co.

COMMUNICATION & SIGNAL EQUIPMENT



47—Clocks and Signals

New engineers' and architects' catalog contains general descriptions, illustrations, specifications, and complete details on time and program systems (electronic, synchronous wired, *Autoset* impulse); clocks (secondary, synchronous, wall, double-faced, tower, special designs); signal equipment.

Stromberg Time Corp.



53—Signal and Alarm Systems

Bulletin 76-4999 describes three Honeywell signal systems for: 1) Programming over a master-time system (easiest to set); 2) fire protection (complete line, reliable source); and 3) critical-equipment surveillance from a central station (circuitry carries supervision plus communication over single pair of wires). *Minneapolis-Honeywell Regulator Co.*



48—Community TV Systems

Bulletin M-50-49 describes Blonder-Tongue *Masterline* equipment for multi-set operation in master and community TV systems. Consists of the main folder, an article on installing master TV systems in motels, catalog sheet of specifications, and price list. Bulletin is illustrated, includes amplifier specifications. *Blonder-Tongue Laboratories, Inc.*



54—School Sound Systems

Four-page brochure 7316-E-58 illustrates and describes a new and complete line of school sound distribution systems. It covers equipment suitable for the smallest to the largest school units. Building block flexibility of console styles, panels, and functions explained. Specification sheets furnished on request. *DuKane Corp.*



49—Hospital Signaling Equipment

Bulletin 137 includes wiring diagrams, specifications, and equipment data on visual paging, doctors register systems; and visual, psychopathic, manual and automatic audio-visual nurses call systems. The bulletin details one of the most complete lines of hospital signaling equipment.

S. H. Couch Co., Inc.



55—Audio-Visual Nurse Call Systems

Catalog 387E describes the operation of Executone's Multi Audio Visual Nurse Call System for hospitals, which enables nurses to answer a patient's call from any nurse control station in the system. Contains complete technical information on all components, system wiring diagrams, sample specifications. *Executone, Inc.*



50—Doctors' Register Systems

Brochure 22 describes the new *Dial-In Doctors' In-and-Out Register System* for large hospitals. The system permits inexpensive placement of registers at all doctors' entrances, eliminates space and wiring problems, reduces installation expense, and facilitates future expansion. For existing hospitals or new. *Auth Electric Co., Inc.*



56—Modern Signal Systems

A pocket size resume of all Edwards products for industrial and commercial applications. It fully describes the advantages and convenience of modern signaling, covering the full range from large control, communications and protection systems to single components. Various products pictured. *Edwards Co., Inc.*



51—Internal Telephone Systems

Catalog S-140 describes the benefits of a complete private internal telephone communications system. It points out profits, economy, and convenience offered by four Stromberg-Carlson switchboards with capacities from 10 to 74 lines. Four different type telephones either desk or wall are illustrated. *Stromberg-Carlson, Special Products Div.*



57—Indicating and Alarm System

Bulletin 3036C describes in detail the Edison *Omniguard* indicating and alarm system. A reliable, low-cost temperature detection for small or large installations. Features, operation, specifications, connections, wiring diagram, and installation procedures are given. Various types are pictured and described. *Thomas A. Edison Industries.*



52—Sound Specification Manual

Engineering specification manual, 40 pages, gives complete detailed specifications on central sound systems for schools, industry, and institutions. Single, dual, and three channel systems are fully outlined with typical systems specifications covering the entire equipment for modern sound coverage. *Rauland-Borg Corp.*



58—Stereo and HiFi Music Systems

Altec's new catalog AL 1302-1 features illustrations of custom stereophonic and monophonic installations. A special feature is the section which diagrams the proper placement of speakers and other components in a room. All components are described in detailed technical information and specifications. *Altec Lansing Corp.*

COMMUNICATION & SIGNAL EQUIPMENT continued

**59—Announcer Systems**

Catalog 100C describes annunciation systems manufactured by Panalarm. The function, benefits, and selection of Panalarm annunciation systems are discussed. Included in this 50 page catalog are dimensions, plug-in relays, remote equipment and components, accessories, engineering data, and ordering information.

Panalarm, Division of Panellit, Inc.

**65—Public Address Systems**

New catalog SWC 17e/AL describes and shows examples of Altec's sound system building block flexibility. Each specialized component illustrated in the catalog is designed to work in complete harmony with every other item in the Altec line—microphones, amplifiers, preamplifiers, loudspeakers, and horns.

Altec Lansing Corp.

**60—School Communication Systems**

Catalog 482C describes the operation of Executone's new school communication system providing dual channel sound facilities (plus intercom), time signals, alarms, emergency announcements, and many other features. Contains complete technical information on all components, system wiring diagrams, specifications.

Executone, Inc.

**66—Apartment Telephone Systems**

Bulletin ACAD, loose-leaf pages, describes two-way communication systems between apartments and the vestibule or lobby; also the house manager and trades entrance, if required. Cordless loudspeaking telephones throughout prevent theft and vandalism. Types of equipment pictured, wiring diagrams, specifications.

Auth Electric Co., Inc.

**61—Industrial Intercom Systems**

Bulletin 2-1293 describes Amplicall industrial intercommunication and paging systems. Paging is done through a 30 watt amplifier to penetrate high noise levels. Twelve positions for intercom conversation. Operation is completely explained and cable requirements given. Includes pictures and specifications.

Rauland-Borg Corp.

**67—Communications Equipment**

A new convenient wall chart of electronic and communications equipment symbols is offered consulting engineers. This time-saving guide is based on IRE, NEMA, and MIL standards and covers sound distribution, paging, private telephone, intercom, nurses' call, and MCS equipment symbols (17 x 22 in.).

DuKane Corp.

**62—Telephone Equipment**

S. H. Couch Company's 12 page bulletin 128A includes wiring diagrams, specifications, and equipment data on U.S. approved mailboxes and apartment house telephone equipment. A variety of equipment is outlined to meet requirements of all types of apartment houses, both large and small.

S. H. Couch Co., Inc.

**68—Transistorized Intercom**

Bulletin 3J3624 details in words and pictures RCA's handsome new *Instant-Call* intercom. Among its unique features are transistorized circuitry, reminder signal, busy signal, and conference call. Diagrams illustrate flexibility of system and suggest ways of cutting cost through efficient use of equipment.

Radio Corporation of America.

**69—Clock and Program Systems**

Bulletin CL-572 describes the centrally controlled clock and program systems for schools, institutions, public buildings, and industry. Included is description of various systems with illustrated wiring diagrams. Features and applications of various types of clocks and audible signals are discussed. Specifications given.

Edwards Co., Inc.

**70—School Communication Systems**

Catalog S-104R illustrates and describes 17 models, single channel to three channel communications systems. Both table top turrets and consoles with capacities from 22 to 180 rooms. Provisions included for telephone intercom, loudspeaker intercom, high fidelity FM-AM radio tuner, 3-speed transcription player.

Stromberg-Carlson, Special Products Div.

**64—Time Recording Systems**

"First Quality for Timing Accuracy" contains general description of electronic, synchronous wired, and *Autoset* impulse time and program systems with illustrations of the master time control, secondary clocks, and signals. Also illustrated and described briefly are attendance time recorders, job cost recorders.

Stromberg Time Corp.

DIRECTORY OF ADVERTISERS' LITERATURE

ELECTRICAL APPARATUS



71—Motor Controls

Engineers concerned with control will find reference book 14C9462 a quick guide for starters and contactors. Capsule descriptions are provided on a complete line of ac and dc, low and high voltage, air-break and oil-immersed contactors and controllers. Includes control centers, push-buttons, and switches.

Allis-Chalmers.



72—Durasheath Rubber Power Cable

Bulletin C-102 describes Anaconda's complete line of high voltage and low voltage rubber-insulated power cables for use in utilities, metal industry, and petroleum, chemical and processing industries, as well as residential and commercial buildings. Data on cables ranging from 600 to 15,000 volts.

Anaconda Wire & Cable Co.



73—Varidrive Motors

Bulletin F-1797, "Variable RPM's Control Production Tempo—U.S. Varidrive, the Miracle Motor," 18 pages, full color, describes combined motor and integral V-belt drives providing stepless speed changes 2 to 10,000 rpm, $\frac{1}{4}$ to 75 hp. Space-saving, vertical or horizontal in many models.

U. S. Electrical Motors, Inc.



74—Underfloor Electrical Raceways

Manual 3011-A outlines a new method of underfloor electrification using the top chord of a newly designed steel joist for electrical raceways. Gives details and outlines method of obtaining underfloor electrification economically. Pictures show step-by-step installation of accessories and use procedures.

Ceco Steel Products Corp.



75—Aluminum Plug-in Duct

Bulletin SD-110 describes Square D aluminum plug-in duct with I-beam construction of bus bars. The 6-page, 2-color bulletin explains use of plug-in duct, tells why aluminum is used as a conductor. Includes convenient voltage drop curves, suggested specifications, and list of available accessories.

Square D Co.



76—Vertical Induction Motors

Product Publication 230 provides a detailed description of a line of vertical induction motors rated from 60 to 4000 hp. The units are built either with solid or hollow shafts in all standard voltages. Torques and starting KVA requirements are matched to loads. Cutaways show construction and operation.

Electric Machinery Mfg. Co.



77—Standby Electric Plants

A guide to selection and installation of Onan standby electric plants and controls. Eight-page folder 32C/ON deals with need for standby power and choice of electric plant. Data on gasoline and diesel sets given in sizes up to 230kw. Automatic ac transfer controls are also described and illustrated.

D. W. Onan & Sons Inc.



78—Emergency Power Guide

Booklet 40-20205-DN927 is Caterpillar's guide book for emergency power. Describes in detail the three sources of standby power — central battery systems, two circuit systems, and emergency generator sets. Details many advantages of diesel generator sets. Selection of proper diesel.

Caterpillar Tractor Co., Engine Division.



79—Armored Power Cables

Bulletin RCP-730 describes three-conductor Rozone A insulated interlocked armored power cables for 600- to 15,000-volt service. Used for modernizing, expanding, and building plant power capacity. Advantages are detailed and illustrated. Complete specifications on various voltage ratings given.

Rome Cable Division of Alcoa.



80—Dry-Type Transformers

Bulletin GEC-1047 is a buyers guide to help you specify and order dry-type transformers. This is a quick and easy-to-use single source of specifying and ordering information. Pictorial index gives basic descriptions, application information, and page numbers for prices, dimensions, and other data.

General Electric Co.



81—Power Circuit Transformers

Bulletin P571-15 describes Jefferson's power circuit transformers, the economical, efficient approach to better power distribution. Line drawings combined with tables give all dimensional data. Application data includes selection, mounting, and conversion. Also given are wiring diagrams and specifications.

Jefferson Electric Co.



82—Aluminum Conduit Fittings

Catalog 59 lists, in condensed form, all types of aluminum conduit fittings made by Killark Electric Mfg. Co. Contains dimensional data of such items as circuit breakers, conduit bodies, connectors, explosion-proof vapor-tight and dust-tight fittings and fixtures. Catalog numbers keyed to separate price list.

Killark Electric Mfg. Co.

CONSULTING ENGINEER

ELECTRICAL APPARATUS continued

83—Wiring Devices



Catalog 2-57 describes various wiring devices manufactured by the Slater Electronics Corporation. Includes appliance switches, lampholders, power outlets, receptacles, switches, weatherproof devices, wall plates, and automatic *Kazo-A-Lite*. Lists comparative catalog numbers with other companies.

Slater Electronics Corp.

89—Master Laytex Portable Cord



Booklet KW-896 describes remarkable portable cord. Tests show Kaiser Master Laytex superiority in combating eight causes of cord failure and how it does the job of 3 conventional mold-cured cords. Book describes tests, charted results, and lists applicable specifications. Cutaways and photographs.

Kaiser Aluminum & Chemical Sales, Inc.

84—Controlway Systems



Bulletin describes Cope *Controlway*, a low cost method of supporting low voltage control cables, signal cables, and instrument tubing. Advantages of *Controlway* are listed. *Controlway* is illustrated as are other Cope cable supporting systems. Complete line of system fittings meet exacting requirements.

T. J. Cope Div. of Rome Cable Corp.

90—Porter Products



Bulletin listing products manufactured by H. K. Porter Co., Inc. Products include steel, specialty alloys, wire, wire rope, fabricated products, copper and aluminum wire, refractories, electrical products, tools, rubber, synthetics, and friction materials. A few division plants are pictured. Sales offices listed.

H. K. Porter Co., Inc.

85—High Voltage dc Transmission Link



Booklet 7434E, "The Gotland DC Link" describes in detail high voltage dc transmission between the mainland of Sweden to the island of Gotland. This transmission has been operating successfully for many years. Photographs and schematic drawings together with copy show how this transmission link was constructed.

ASEA Electric, Inc.

91—Interrupter Switches



Bulletin 1610B describes and illustrates arc chute type interrupter switches, fused and unfused, for switching feeder circuits. Usually metal enclosed, switch can be wall mounted or free standing, dimensions shown for both. Switches can close in on moderate faults. Diagrams show principal forms of switches.

I-T-E Circuit Breaker Co.

86—Electrical Systems Design Book



Bulletin B7748 is for use by consulting engineers to prove that the best electrical system is the one which gives the greatest value per dollar of investment. Covers characteristics of good systems — flexibility, service continuity, voltage regulation, efficiency, operational cost, and maintenance. Helps in selection.

Westinghouse Electric Corp.

92—All-Purpose Control Cable



Bulletin DM-5844 gives full technical data on Anaconda's thermoplastic all-purpose control cable with polyethylene insulation, double Densheath (PVC) jackets. Offers 7-wire stranding, excellent electrical characteristics, easy installation. Resists chemicals, mechanical abuse, moisture, heat deformation.

Anaconda Wire & Cable Co.

87—Electrical Tapes



Bulletin 74-50 describes plastic tape, friction tape, rubber tape, and vinyl tape manufactured by Johns-Manville, Dutch Brand Division. Outstanding advantages and technical data given on each type of tape. Booklet is completely illustrated with photographs of products and drawings of applications.

Johns-Manville, Dutch Brand Division.

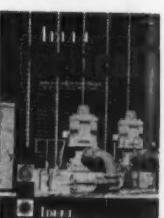
93—Switchboard Layout



This 72-page bulletin gives complete layout and specification information on Square D 14-in. switchboards. Separate sections on circuit breakers and fusible equipment for service and distribution systems. Contains detailed layout and dimension drawings, wire and conduit tables, and lists NEC requirements.

Square D Co.

88—Large Vertical Motors



Bulletin 219 describes Ideal hollow and solid-shaft squirrel cage induction, synchronous, and wound rotor vertical motors (frames 584 and larger, 150 hp and up) for various requirements and conditions. Bearing and coupling sizing and selection data, sample specifications, and typical Ideal installations.

Ideal Electric & Manufacturing Co.

94—Electrical Controls



Engineering reference catalog 18A contains a complete line of standard Zenith electric controls and timing devices. Photos, diagrams, engineering data, and prices on automatic transfer switches, magnetic contactors, remote control switches, program clocks, automatic reset timers, cycle timers, and special controls.

Zenith Electric Co.

To order personal copies of these bulletins

DIRECTORY OF ADVERTISERS' LITERATURE

ELECTRICAL APPARATUS continued



95—Low Voltage Circuit Breakers

Bulletin 6004-C provides a complete review of I-T-E Circuit Breaker Company's new low-voltage power circuit breakers and switchboards. They range in unit ratings from 225 to 4000 amperes. Advanced features of the new K-Line breakers, rated at 225, 600 and 1600 amperes, are described.

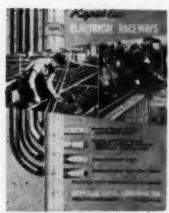
I-T-E Circuit Breaker Co.



96—Fuse-Fuseholder

New Buss fuse-fuseholder combination for protection of individual fluorescent fixtures and other equipment on circuits of 300 volts or less. Bulletin SFH-6 tells how individual fusing reduces hazards of fires and explosions. Bulletin specifies the size fuse to use and where to locate it for the best protection.

Bussmann Mfg. Div., McGraw-Edison Co.



97—Electrical Raceways

Bulletin SA-EMT-59 contains data on the complete line of Republic electrical raceways. Exclusive features and various design data are shown. Products included are *Electrunite EMT* (Electrical Metallic Tubing), rigid threaded steel conduit, plastic coated *EMT* and rigid conduit, plastic pipe and other products.

Republic Steel Corp.



98—Panel Instruments

Bulletin 3-15, 24 pages of descriptive information and illustrations, covers a full line of panel instruments from standard commercial use to military applications. Includes ac and dc meters, elapsed time meters, aircraft instruments and shunts, and current transformers. Dimension drawings.

Federal Pacific Electric Co.



99—Terminating, Splicing Fittings

"O.Z. Terminating and Splicing Fittings for Interlocked Armor Cable," 36-page engineering bulletin 135A, gives complete specifications, dimensions, cutaway drawings, photographs, and installation instructions. Prices and weights also are given for each item, along with ordering data and available materials.

O. Z. Electrical Mfg. Co.



100—Electrical Power Equipment

Catalog SM-244, 16 pages, describes in detail the modern method for centralizing electrical power distribution and motor control equipment for industrial applications. It also contains suggested ideas for control specifications, and gives a simplified selector for use in control center layout and planning.

Square D Co.



101—Terminals and Splices

Catalog 320 illustrates over 300 quick-connect terminals and splices for appliance, automotive, and other equipment wiring. The booklet contains test data, dimensions, and applications. Complete details of high speed pneumatic and electric wire terminators for mass production of leads and harnesses included.

AMP Inc.



102—Electrical Motors

New Westinghouse Life Line "A" motors set standards of motor performance for greater application flexibility. Stronger insulating materials, best electrical performance, improved accelerating torque, pre-lubricated bearings, dynamic balancing of moving parts, armorized frame and other features are explained. Westinghouse Electric Corp.



103—Dry-Type Transformers

This bulletin 958A describes and illustrates Sorgel Electric Company's standard line of low sound level dry-type transformers in ratings of $\frac{1}{4}$ to 333 kva single phase and 1 to 10,000 kva three phase, 120 to 15,000 volts suitable for varied installations. Consultants will find the book valuable.

Sorgel Electric Co.



104—Motors and Generators

Bulletin 43-205 contains product information on high speed and low speed synchronous motors and generators. Looseleaf form, punched for three-ring binder. Gives information on low speed, high speed, and vertical-type construction, insulation, and exciters. All pages fully illustrated. Pictures of installations.

Electric Products Co.



105—Transformer Buyer's Guide

Bulletin 1047, Buyer's Guide to help in specifying and ordering dry-type transformers. A quick and easy-to-use single source of specifying and ordering information. Pictorial index gives basic descriptions, application information, and page numbers on which prices, dimensions, and other data are found.

General Electric Co.



106—Metalclad Switchgear

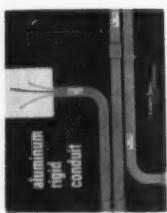
New brochure describes components, applications, and performance of metal-clad switchgear, ratings to 500 MVA short circuit interrupting and 44,500 amp fault closing. Drawings show substation, switching center, and service entrance applications. Typical installations and construction shown.

S & C Electric Co.

ELECTRICAL APPARATUS continued

**107—Constant Current Transformers**

Bulletin SL-703 describes in detail the electrical and mechanical features of Moloney's exclusive double moving coil design constant current transformers. Types of street lighting transformers described include dry type, subway type, and oil filled conventional and protected units of both the standard and high power factor. *Moloney Electric Co.*

**108—Rigid Aluminum Conduit**

Bulletin EC-885 describes Kaiser's rigid aluminum conduit. It is light weight, corrosion resistant, nonmagnetic, non-sparking, and easy to install. Standard installation procedures, dimensions, weights, and packaging details are given. Industrial applications are listed. Illustrated with photographs and diagrams. *Kaiser Aluminum & Chemical Sales, Inc.*

**109—Switchgear**

Bulletin 3-440 gives feature-by-feature description of most modern design switchgear. Discussed are construction and operation of 5 and 15 air circuit breakers: indoor and outdoor housing construction, compartmentation, and simplified installation and maintenance. Ordering information, arrangements. *Federal Pacific Electric Co.*

**110—Protective Fuses**

Bulletin HCS tells how Buss Hi-Cap fuses have unlimited interrupting capacity on any voltage up to 600 to provide safe protection for loads above 600 and up to 5000 amperes. Describes operating characteristics and advantages, illustrates dimensions, contains charts on current limiting effect and opening times. *Bussmann Mfg. Div., McGraw-Edison Co.*

**111—Molded Case Circuit Breakers**

Compact pocket-size bulletin 5004-1A gives construction and performance features, ratings, and details on complete line of I-T-E molded case breakers by types, current ratings, overcurrent devices, accessories, and modifications available. Each model is illustrated in column over specifications. *I-T-E Circuit Breaker Co.*

**112—High Speed Generators**

Construction, design, and simplified maintenance features, as well as application and specification data on high speed generators are included in bulletin 505. Exploded views and schematic drawings of complete assemblies with detail of Ideal's patented bearing and oil seal shown. *Ideal Electric & Manufacturing Co.*

**113—Low Voltage Circuit Breakers**

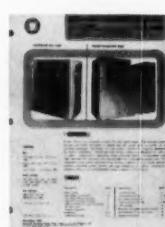
Bulletin 4261-2B describes I-T-E's new *U-Re-Lites*, individually enclosed low voltage power circuit breakers. Information includes design, safety features, enclosure dimensions, selection chart, application data, and coil ratings. All features are illustrated photographically, as well as installation procedures. *I-T-E Circuit Breaker Co.*

**114—Single, Multi-Speed Starters**

Describes single and multi-speed starters, including combination and reversing starters, plus Square D Spin Top enclosures for hazardous locations. Also describes motor control racks for field mounting of *Spin Top* enclosures and other equipment. Bulletin includes price and dimension information. *Square D Co.*

**115—Cathodic Protected Cable**

Recent figures show America's annual bill for corrosion is six billion dollars. Bulletin 1033 on Simplex cathodic protection cables offers information on the most effective means of combating this expensive problem. Simplex cathodic protection cables are available with a wide variety of insulating materials. *Simplex Wire & Cable Co.*

**116—Power Centers**

Bulletin 47-350 contains descriptive information and operating data regarding the new Westinghouse self-contained dry or liquid type power centers. Illustrations and technical information on application and rating capacities. Dry type transformers are ventilated or sealed and liquid units are oil or inertane-immersed. *Westinghouse Electric Corp.*

**117—"Rocker-Glo" Switches**

Illustrated four-page brochure describes new *Rocker-Glo* switch by Pass and Seymour. It has a luminous button and operates silently. Available in 15 or 20 amp, 120/277 volts ac. It has easy-to-wire pressure or screw terminals. Comes in Despard type with strap or Despard interchangeable. *Pass & Seymour, Inc.*

**118—Switchboards**

Bulletin 2015 is an illustrated review of fusible and circuit breaker switchboards through 2,000 amps. Descriptions of incoming line, distribution, and combination metering and distribution sections with fusible, circuit breaker, and motor control components. Tables, specifications, layout and dimensions. *Federal Pacific Electric Co.*

To order personal copies of these bulletins file

DIRECTORY OF ADVERTISERS' LITERATURE

ELECTRICAL APPARATUS continued



119—Primary Unit Substations

Economy, reliability, safety, and convenience are advantages offered by new I-T-E primary unit substations. Four-page bulletin, S-2701-1A details data on the I-T-E line in ratings from 6900 through 69,000 volts incoming and 2400 through 13,800 volts outgoing. Incoming, transformer, outgoing sections illustrated.

I-T-E Circuit Breaker Co.



120—Varnished Cloth Wires, Cables

Catalog VC-1-59 contains 64 pages of NEMA-IPCEA technical data. Includes conductor information, insulation thicknesses, weights and dimensions, current carrying capacities, and general design information on varnished cloth insulated wires and cables. Useful in the planning of power supply systems.

General Cable Corp.



121—Stabilizing Transformers

Bulletin GEA-5754D gives a quick, easy-to-use source of specifying and ordering information on the General Electric voltage stabilizing transformer. This illustrated bulletin tells why voltage varies, how voltage stabilizing transformers work advantages, operating characteristics, and where they are used.

General Electric Co.



122—Renewable Fuses

Bulletin 1320, a 12 page catalog, covers the complete line of Federal Pacific's economy renewable fuses. Cutaway drawings, photographs, cross-sectional diagrams, and time-current curves fully explain the construction and application features of both ferrule and knife blade fuses as well as economy renewal links.

Federal Pacific Electric Co.



123—Continuous Power Systems

Bulletin 21-200 describes the Inverter-Divertor, the continuous ac and dc power system. It supplies standby power instantaneously without losing even a fraction of a cycle. Includes features, construction, and operation. Oscillogram shows transfer from normal to emergency operation caused by 10% undervoltage.

Electric Products Co.



124—Cable Supporting Systems

Catalog 1257 describes Cope cable supporting systems — cable trough, cable ladder, channel support systems, and accessories. Each type of cable support is explained and illustrated. Product identification line drawing keyed to index makes this loose-leaf catalog easy to use. Parts are illustrated. Available sizes.

T. J. Cope Div. of Rome Cable Corp.



125—Duct Floors for Electrification

Sixteen-page booklet, "Electrical Outlets Wherever You Need Them," gives complete details on RLC duct floors, a new development which provides 100 percent electrical flexibility for buildings at a remarkably low cost. The illustrated booklet is published by the Concrete Steel Reinforcing Institute.

Concrete Steel Reinforcing Institute.



126—Dimmerboard Systems

This 24-page bulletin explains basic components of stage dimmerboard systems, as well as optional components and features. Complete description of standardized dimmerboards, plus convenient selection chart. Specifications for all types of dimmerboard systems and layout dimensions are included.

Square D Co.



127—Saturable Reactors

Bulletin 658 illustrates and describes Sorgel saturable reactors to control, regulate, and vary electric power from 1 kva to 3000 kva, for various manufacturing processes, either manually or automatically. Also includes a questionnaire form to fill in to obtain complete information for any application.

Sorgel Electric Co.



128—Load Tap Changing Equipment

Bulletin LTC-2907 describes the operating principle of Moloney's load tap changing equipment incorporating an exclusive reactor, by-pass, switching principle. Applications are shown in pictures with accompanying circuit diagrams. General construction and that of various mechanisms are explained and illustrated.

Moloney Electric Co.



129—Explosion-Proof Fittings

Catalog of aluminum explosion-proof fittings for hazardous locations. Included are junction boxes, conduit bodies, sealing fixtures, plugs and receptacles, pilot lights, switches, and fixtures. Complete dimensional data makes ordering easy. Special fittings made to order. Catalog numbers keyed to separate price list.

Killark Electric Mfg. Co.



130—Molded Case Circuit Breakers

Fundamentals of short-circuit protection for motor circuits in 8-page bulletin 5040-A. Features and applications of ETI molded case breakers are reviewed and pictured. Bulletin tabulates instantaneous trip range of ETI frame sizes and suggested trip setting positions for various horsepower motors.

I-T-E Circuit Breaker Co.

CONSULTING ENGINEER

ELECTRICAL APPARATUS continued



131—Low Voltage Circuit Breakers

Bulletin GEA-5915E describes General Electric's full line of low voltage power circuit breakers, both manually and electrically operated. Photographs show components. Included are ratings, operating currents, selection and application data, guide form specifications, accessories, and dimensions.

General Electric Co.



137—Hi-Lo Dimswitches

Bulletin 1545 describes the Slater *Hi-Lo* dimswitches. This switch will replace any existing switch for incandescent lamps. Fits any standard switch box. No rewiring necessary. In low position gives 30% of light. Increases life of bulb; saves electricity. Types of plates available are shown. Wiring diagrams.

Slater Electronics Corp.



132—Electrical Fittings

Loose-leaf catalog 135 has been prepared to provide all the technical information you need to select the right conduit fittings, cable terminators, cast iron boxes, and solderless connectors for each of your electrical installations. It includes a comprehensive index and a section of useful engineering data.

O. Z. Electrical Mfg. Co.



138—Protective Relays

Catalog 5-020 describes Federal Pacific's complete line of protective relays. Featured are 15 models of protective relays, representing 8 different types. Tabular data, special features, design, settings, burdens at 60 cycles, contacts, and case given. Photographs and descriptive material detail its application.

Federal Pacific Electric Co.



133—Dry-Type Transformers

Bulletin 46-950 contains complete statistical information on single and three-phase dry type transformers. For each type transformer there are dimension and layout drawings, limit capacities, such engineering application data as decibel readings, space and weight saving features, case temperatures.

Westinghouse Electric Corp.



139—Open Polyphase Motors

Bulletin MU-223 describes open polyphase motors with drip-proof construction in NEMA frame, sizes 182 through 445U, 1 to 125 horsepower. Bulletin contains selection data, motor dimensions, performance curves and ratings. Pictured are features and the complete line of Wagner motors for modern requirements.

Wagner Electric Corp.



134—Metallic Sheathed Cables

Bulletin 1031 contains questions and answers on Simplex's new sealed metallic sheathed cables. Simplex C-L-X is a continuous, lightweight, metallic cable sheath which is impervious to gases, chemicals, and water. Its construction, with a thermoplastic covering, gives a combination of unmatched properties.

Simplex Wire & Cable Co.



140—Compact Unit Substations

Bulletin 5604-1A describes *Tranfo-Units* for indoor or outdoor, ratings 45 through 2500 kva, primary through 14.4 kv, secondary through 600 volts. These units, completely pre-engineered load centers for stepping down primary voltages, contain transformer and its primary and secondary distribution devices.

I-T-E Circuit Breaker Co.



135—Electrical Wiring Devices

Catalog 60, 75 illustrated pages, describes complete range of electrical wiring devices. Both the interchangeable Despard line and the P&S conventional line. Everything from switches to fixtures to devices for every purposes are listed. A 15-page index and price list are also included in this catalog.

Pass & Seymour, Inc.



141—Power, Lighting Transformers

Bulletin 200 contains complete information about Hevi-Duty three-phase dry-type power and lighting transformers. Sizes range from 6 to 2000 kva. Illustrations, outline drawing, sound levels, capacities, prices, dimensions, weights, wiring diagrams, and temperature rise for each transformer are included.

Hevi-Duty Electric Co.



136—Magnetic Motor Starters

Bulletin A-262 describes in detail the advantages and design characteristics of the RA magnetic starter line of the Arrow-Hart & Hegeman Electric Company. Various applications are described, and the space- and weight-saving features of the line are detailed. Illustrated with detailed photographs and drawings.

Arrow-Hart & Hegeman Electric Co.



142—Control Centers

Control Centers in three construction types, NEMA Type "A", "B", and "C" are explained in bulletin B-6722. Information charts on short circuit protection, control center arrangements, selection of starter sizes and starter components, application and engineering data, dimension and circuit diagrams.

Westinghouse Electric Corp.

DIRECTORY OF ADVERTISERS' LITERATURE

ELECTRICAL APPARATUS continued



143—Gas-Filled Cable

Catalog J-947 gives complete technical information on Roebling's low pressure gas-filled cable. Included are physical and electrical characteristics, illustrated splicing and terminating instructions, current-carrying capacities, and accessories. Installation recommendations.

*John A. Roebling's Sons Division
Colorado Fuel and Iron Corporation.*



144—Building-Type Switchboards

Bulletin SA-8305 is designed to assist the consulting engineer in specifying building type switchboards. Includes layout data, dimensions, and specifications for Westinghouse switchboards designed for offices, commercial buildings, hotels, residences, schools, hospitals, stores, and institutional buildings.

Westinghouse Electric Corp.



145—Electrical Plants

Catalog KEP56-1, 24 pages, shows the line of Kohler electric plants used as an independent source of electricity for sole supply and for automatic standby when central station power fails. Sizes range from 500 w to 100 kw, gasoline and diesel. Battery charging units in 6, 12, 36, and 140 v capacity are described.

Kohler Co.



146—Fusible Panelboards

Bulletin 3-320 describes QMQB fusible panelboards from 30 to 1200 amps, 250 to 600 volts. Were developed to meet the increased power of electrical distribution systems. Features are visible blade contacts, dionizing arc quenchers, and high pressure fuse holders. Panelboard selection data included.

Federal Pacific Electric Co.



147—Electrical Equipment Manual

New 20-page manual gives comprehensive specification data on Square D electrical equipment — safety switches, panelboards, switchboards, dimmerboards, control centers, bus duct, and substations. The manual also includes convenient reference guide to National Electric Code requirements.

Square D Co.



148—Assembled Switchgear

Bulletin 32-250 outlines indoor and outdoor assembled switchgear utilizing type DH De-ion drawout air circuit breakers. Contains switchgear engineering design features, outline dimension drawings, application data, and specifications. For commercial buildings, industrial plants, electric utilities and public works.

Westinghouse Electric Corp.



149—Power Switchgear

Bulletin 1616A describes construction, standard assemblies, and standard components for power switchgear with fused and unfused interrupter switches. Metal enclosed units are grouped with common bus, providing flexible arrangements. Operation of switches explained with accompanying operational illustrations.

I-T-E Circuit Breaker Co.



150—PVC Electrical Conduit

Bulletin KFE 1058 lists physical, thermal, and electrical data for nonconducting Kraloy PVC (polyvinyl chloride) electrical conduit, with photographic installation details. Specifications for thin wall conduit ($\frac{1}{4}$ to 2 in.) and standard wall conduit ($\frac{1}{2}$ to 4 in.), all connections, couplings, and fittings are included.

Kraloy Plastic Pipe Co., Inc.



151—Electrical Fittings

Bulletin 1022 listing box connectors, conduit fittings, entrance fittings, lock-nuts and bushings, connectors for MI cable, outlet boxes and covers, fittings for service entrance cable, pull boxes, switch boxes, sealite connectors, fittings for E. M. T. Prices, weight, dimensions, packaging, and features are detailed.

Appleton Electric Co.



152—Instantaneous Emergency Power

Product information folder M-110 describes the new Onan *Instapac*, a transistorized power inverter which converts battery current to ac of proper voltage and frequency to run electronic equipment. Allows time lapse of only .025 seconds between line power interruption and full *Instapac* operation.

D. W. Onan & Sons Inc.



153—Circuit Breakers

"What You Should Know About Circuit Breakers for Branch Circuit Protection," 16-page manual 101, describes ways of protecting your client from fire, equipment damage, excessive wiring costs, and needless circuit interruptions. How hydraulic-magnetic circuit breakers provide this protection is pointed out.

Heinemann Electric Co.



154—Dry-Type Transformers

Bulletin TU-147 describes single-phase epoxy compound filled dry-type distribution transformers. Available in 1 to 10 kva ratings, 600 volts and below. Ideal for lighting, office machines, machine tools, fans and other indoor and outdoor applications. Low sound level makes them suitable for use in quiet working area.

Wagner Electric Corp.

CONSULTING ENGINEER

ELECTRICAL APPARATUS continued



155—Low Impedance Bus Duct

Bulletin 3-125, illustrated review of Federal Pacific's line of plug-in and low impedance bus duct. Contains detailed descriptions on straight sections, fittings, and protective devices. Included are construction details of plug-in duct (225-1000 ampere) and low impedance (600-5500 ampere). Fully illustrated.

Federal Pacific Electric Co.



159—DC Circuit Breakers

Bulletin 4601-1A contains descriptive and technical information on the I-T-E line of Type FB DC current limiting circuit breakers. Type FB circuit breaker features are listed and illustrated. Wiring diagrams, line drawings, weights, dimensions, charts, and application suggestions are contained in the bulletin.

I-T-E Circuit Breaker Co.



156—Integral Distribution Centers

Bulletin GEA-6928 describes GE's dry-type integral distribution centers featuring QHT transformers for applications up to 5000 volts. Installation instructions, features, dimensions and cable space, selection data, ratings, and panelboard components are included. Material specification form helps you specify.

General Electric Co.



160—Relays in Three Designs

Bulletin 5-050 offers information on Type CDG relays in 3 designs: inverse, very inverse, extremely inverse. Intended for use by utility and industrial companies in controlling the distribution of electricity. This 16 pp. bulletin includes illustrations, dimension drawings, wiring diagrams, and current curves.

Federal Pacific Electric Co.



157—Panelboard Circuit Breakers

Bulletin 3103 covers the Heinemann series 0911, an economical panelboard circuit breaker dimensionally interchangeable with other makes. Available in 1- and 2-pole models, 0.050 to 60 amperes, the 0911 uses hydraulic-magnetic actuation to end heat-induced nuisance tripping. Fast short-circuit interruption.

Heinemann Electric Co.



161—Dry Type Transformers

Bulletin 100A contains, in table form, complete statistical information on Hevi-Duty single phase, dry type, insulating transformers, .050 to 500 kva, for power and lighting circuits. Photographs, dimension drawings, capacities, prices, temperature rise, weights, and dimensions are given for each transformer listed.

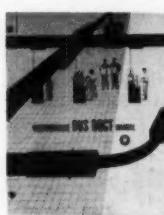
Hevi-Duty Electric Co.



158—Receptacle Openings Chart

These charts, diagramming the approved and standardized receptacle openings and plug blade arrangements of 28 different types of polarized, non-polarized, and grounding devices for 2-, 3- and 4-wire installations, are offered in 17 x 22 in. wall size and 8½ x 11 in. page size. Devices cover a complete range.

Arrow-Hart & Hegeman Electric Co.



162—Bus Duct Layout

Booklet B-4272-D is designed for consultants' use in planning and selection of units for bus duct layout in commercial, institutional, and industrial buildings. Plugin duct, outdoor feeder duct, low-impedance duct, and *Life-line Busway* are fully covered. Completely illustrated with engineering and test data.

Westinghouse Electric Corp.

ENGINEERS' OFFICE & FIELD EQUIPMENT



163—Data Processing System

Booklet 520 introduces the desk-sized IBM 1620, designed primarily to process research and engineering problems. Speed and capabilities are listed together with the advantages to be derived from this advanced storage and computing system. Programming systems available for use with the 1620 are shown.

International Business Machines Corp.



164—Bibliography of Aerial Mapping

File Folder contains special bulletins issued by Kargl Company, Inc. at periodic intervals. Bulletins contain bibliographic information covering all phases of photogrammetry, photography, surveying, and mapping. Includes references to new books, magazine articles, and government pamphlets.

Kargl Co., Inc.

To order personal copies of these bulletins fill in the coupon on page 17.

DIRECTORY OF ADVERTISERS' LITERATURE

ENGINEERS' OFFICE & FIELD EQUIPMENT continued

165—Ozalid's Black-Line Cloth

Bulletin SP59-25 introduces Ozalid's new black-line *Ozacloth*, the cloth intermediate with the highest rated printing speed that makes the best duplicates to make the best prints. *Ozacloth*'s blue tint base cuts glare, reduces eyestrain. Its plastic matte takes ink, pencil, typewriter interchangeably.

Ozalid Div., General Aniline & Film Corp.



166—Aerial Mapping Instruments

Brochure describes precision instruments for aerial surveying, mapping, and photo reproduction. Photographs and specifications cover precision aerial cameras, aerial film viewers, rectifiers, and various models of copy cameras. Rectifier and Junior Copy Camera are autofocus. Senior Copy Cameras have turret lens. *Kargl Co., Inc.*



167—Copyflex Print Makers

Catalog A-2360 explains the basic principles of the Brunning *Copyflex* diazotype process, and how to make fast, economical whiteprints with a wide choice of machines and materials. Complete details on engineering applications and types of reproductions for high quality prints at minimum cost. Fully illustrated. *Charles Bruning Co., Inc.*



168—Print Making Problems

Catalog SPD2 illustrates and describes actual case histories of specific drafting and print making problems that have been solved by the use of certain advanced techniques and products that have been developed by Eugene Dietzgen Company. This well illustrated booklet outlines problems and solutions. *Eugene Dietzgen Co.*



169—Microfilming Systems

A presentation of modern microfilming in booklet form by Recordak, the originator of modern microfilming. Explains the system in precise form. Shows sample films of the various steps in recording a specific engineering drawing. Finally reproductions of the film printed on opaque and translucent vellum stock. *Recordak Corp.*



170—Duratrace Drafting Film

Brochure SP59-13 invites you to safeguard your drawings with Ozalid *Duratrace*. Highly translucent *Duratrace* remains naturally pliable forever. Its fibre-free matte surface takes ink, pencil, typewriter, and corrections exceptionally well. UV or sunlight will not yellow it. A 3" x 4½" sample included. *Ozalid Div., General Aniline & Film Corp.*



171—Planetary Microfilm Camera

Bulletin A-2557 available from the Brunning Co. describing the *Dea-Graph* Model CA7 35 mm planetary camera. Complete specifications for camera, and Model EA1 35 mm enlarger head which converts unit into a microfilm enlarger. Designed for making precision microfilm reproductions of engineering drawings. *Charles Bruning Co., Inc.*



172—Portable Microfilmer

Bulletin A-948 describes the new *Recordak* portable microfilmer. Illustrated in full color, this six page folder explains and illustrates the outstanding features. This portable microfilmer weighs less than an office typewriter, 24 lbs, and measures 6½" x 15½" x 12½". Fits compactly into a handy carrying case. *Recordak Corp.*



173—Electronic Computer

Complete specifications on the new RPC-4000 electronic computing system are given in a catalog sheet S-482. The RPC-4000 is fully transistorized, electronic, stored program, general purpose computing system, for both engineering and business data processing. Consists of computer and a punched tape typewriter. *Royal McBee Corp.*



174—Metal Plan Files

Bulletin AD-C2440-58 describes in detail Art Metal's *Planfile* for the vertical filing of plans, drawings, blue prints, tracings, and sketches. Line drawings and photographs show construction and operation. *Planfile* drawer units are also available. Complete specifications, planning suggestions, and instructions. *Art Metal Construction Co.*



175—Electronic Digital Computer

Brochure S-526R1 describes the Royal Precision LGP-30, a desk-sized, stored-program, general purpose electronic digital computer. Specifications and features are listed and illustrated. New optional photo-electric punched tape reader and high-speed punch unit illustrated. Components described and pictured. *Royal McBee Corp.*



176—Surveying Instruments

Bulletin 6000 describes in detail the Watts Microptic Theodolites offered by Eugene Dietzgen Company. Distinguishing features and specifications are given on Model No. 1 and No. 2. Also includes information on the new *Autoset* level, *Microptic engineers* level, and the precise level. Completely illustrated. *Eugene Dietzgen Co.*



FIRE PROTECTION EQUIPMENT



177—Fire Alarm Systems

Catalog illustrates and describes Standard's March Time, Master Code, and Box Code systems. Also covered are supplemental pre-signal circuits, non-code continuous sounding bells and horns, code transmitters, control panels, stations, detectors, signals, and accessories. Specifications included.

Standard Electric Time Co.



182—Protective Asbestos Coating

Bulletin SL-8 describes fire-protection, acoustical control, anti-sweat, and heat-saving properties of sprayed *Limpet* asbestos, a simple sprayed-on blanket of 100% asbestos which adheres to all interior surfaces without hiding decorative details. Up to four hours fire-protection provided to beams and floors.

Keasbey & Mattison Co.

To order personal copies of these bulletins, please fill out the card between pages 2 and 3 or 58 and 59.



178—Fire Ventilators

Pyrojectors open automatically in case of fire or explosion to vent heat, smoke, and gases up through the roof to prevent major destruction caused when solid roof spreads fire outward. Ruggedly constructed. *Pyrojectors* open at 212° F., air pressure over 10 psf or by manual operation. Complete engineering data. Swartwout Fabricators, Inc.



183—High Pressure CO₂ Systems

Folio 8-1 describes Cardox high pressure carbon dioxide systems. First performance-engineered high pressure system. Constantly energized continuously monitored actuation systems. New safer protection for widely scattered, or many small "hot spots", or where plant location and design precludes bulk systems. *Cardox, Division of Chemetron Corp.*



184—Fire Hydrants

An AWWA compression type, dry head fire hydrant with swivel flange below nozzles permitting nozzle section to be rotated 360° without removing bolts. Outer protection case permits removal of complete barrel for replacement or repairs without excavating. Bell, mechanical joint or flange pipe connections. R. D. Wood Co.



179—Fire Hydrants

Bulletin 56H describes different types of fire hydrants, all complying with American Water Works Association's latest specifications. Engineering features, material specifications, construction details, various assemblies in exploded views, and installation dimensions are shown. Also included are directions for ordering. *Ludlow Valve Manufacturing Co., Inc.*



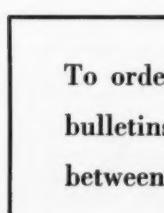
185—Industrial Fire Ventilators

Scientific paper dealing with disastrous spreading of industrial fires when no openings are provided for escape of super-heated air and smoke, and the solution: Colt dual purpose fire ventilators which drop open in case of fire and act as an efficient natural ventilating system in normal plant operation. *Colt Ventilation of America, Inc.*



180—Fire Check Book

Fire Check Book is designed as a handy reference for use in the selection and installation of non-sprinkler fire protection equipment. It shows the basic requirements for standpipe system, hose station, extinguisher, and exterior centers. Check Book includes coupon specifications forms which simplify spec-writing. *W. D. Allen Manufacturing Co.*



To order personal copies of these bulletins, please fill out the card between pages 2 and 3 or 58 and 59.



181—Low Pressure CO₂ Systems

Folio 1-1 describes the Cardox low pressure carbon dioxide systems for maximum protection of "hot spots", any number — indoors or out! Originated, pioneered, and engineered exclusively by Cardox, these systems give carbon dioxide a scope and performance not achieved in any other system or method of application. *Cardox, Division of Chemetron Corp.*



186—Standpipe Units

First major improvements in thirty years in standpipe fire protection units is completely illustrated and described in this four-page folder. Features hose storage rack on door for increased fire-fighting efficiency. Unit saves wall space. Lower installation costs, lower price, Underwriters' approved.

W. D. Allen Manufacturing Co.

To order personal copies of these bulletins f

DIRECTORY OF ADVERTISERS' LITERATURE

HEAT EXCHANGERS & WATER HEATERS



187—Gas-Fired Water Heating Systems

A Guide to the proper sizing, selection, and installation of gas-fired water heating systems for all types of restaurants and cafeterias. Various types of dishwashing equipment are described. Basic information is furnished on water and gas piping, venting, and required clearances. Diagrams and cutaways.

American Gas Association.



188—Heating Radiation Water

Complete information on heat exchangers for heating radiation water with steam is supplied in this 32-page catalog. Rating tables are supplied for 67 different units with 10, 20, 30 and 40 degree temperatures and steam pressures ranging from 2 to 25 pounds. Catalog SC-159 also includes material specifications.

Bell & Gossett Co.



189—Panelcoil Data Sheets

Panelcoil data sheets series 28 through 59 give complete engineering specification tables on complete Dean line of single and double embossed Panelcoils. Use with bulletin 259, showing heating and cooling application data and prices. Superior Panelcoil takes the place of pipe coils and tubing.

Dean Products, Inc.



190—Heat Exchangers

Catalog HEC-1R covers carbon steel heat exchanger and condenser tubes. A typical specification, A.S.T.M. A-214, covering this grade of tubing has been broken down paragraph by paragraph to show how Electrunitite tubing is processed to meet each requirement. Photographs show various production operations.

Republic Steel Corp.



191—Heating and Cooling Cells

New Acme Industries catalog 385-A describes and illustrates Acme's complete line of Turbaire chilled water and direct expansion cooling coils, hot water and steam heat coils. Complete engineering data, dimensions, and selection and ordering procedures are included in this new catalog.

Acme Industries, Inc.

To order personal copies of these bulletins, please fill out the card between pages 2 and 3 or 58 and 59.



192—Heat Transfer Equipment

Bulletin HE-8 describes the wide range of heat transfer equipment built by Vogt. Standard and custom built types from steel, alloys, or nonferrous materials for every temperature, pressure, or vacuum service. Conforms to all codes. Features of design shown for each type of heat exchanger. Fully illustrated.

Henry Vogt Machine Co.



193—Industrial Water Heating System

Bulletin 923 tells how Schaub Iso-Therm hot water heating system eliminates over-loading and peak steam demand by modulating flow of incoming make-up water to hold constant water temperature without taxing boiler beyond average heating rate. Prevents water temperature drop. Sizes to 20,000 gph.

Fred H. Schaub Engineering Co.

HEATING & VENTILATING EQUIPMENT



194—Tubeaxial Fans

Bulletin 620 illustrates and describes Type BT and BTV belt driven tubeaxial fans for handling corrosive fumes, high temperatures, explosive fumes, abrasive dusts, dirt laden air, and high humidity. Drawings are shown for totally enclosed, corrosion resistant, and ventilated assemblies. Ratings and sizes chart.

Robbins & Myers, Inc., Propellair Div.



195—Centrifugal Roof Ventilators

Bulletin SDA-220 deals with the Peerless belt and direct drive centrifugal roof ventilators which have recently been added to the Peerless roof ventilator line. Features, construction details, performance data, dimensions, and specifications are presented together with illustrations of the products.

Peerless Electric, Div. of H. K. Porter Co.

HEATING & VENTILATING EQUIPMENT continued

**196—Space Heaters**

Catalog 2859 illustrates and fully describes how to effectively space heat in buildings with high ceilings. Sixteen pages include technical data, mounting heights, spread circle diameters, unit capacities of 30 sizes, specifications, and dimensional drawings. Complete charts, tables, and graphs included.

Young Radiator Co.

**197—Airfoil Blade Fans**

Catalog 859 describes a new line of highly efficient, quiet airfoil blade fans. Dynafoil fans are particularly applicable to mechanical draft and heavy duty applications, such as industrial processes, conduit air conditioning, and tunnel ventilation. Various arrangements and panel openings pictured. Dimensions given.

Clarcage Fan Co.

**198—Radiant Panel Heating**

"Radiant Panel Heating with Steel Pipe," 48 pages, covers the history of this type of heating, basic design, floor, ceiling, and wall panels, information on snow melting systems, pipe coil integration, design of a floor coil system, and a boiler hook-up diagram.

*Committee on Steel Pipe Research,
American Iron and Steel Institute.*

**199—Gravity Ventilators**

This bulletin describes the two unique features of the Colt S.R. Series of low silhouette natural gravity ventilators: (1) Hinged top flaps open for normal extraction, full for optimum extraction in hot weather, seal heat in when fully closed. (2) New aero-foil curve design produces maximum positive extraction.

Colt Ventilation of America, Inc.

**200—Infra-Red Industrial Heaters**

Bulletin PC 158 30-3 describes *Panelbloc*, the infra-red radiant industrial heater. Brochure explains the many advantages of infra-red heating over conventional type heating. Typical industrial and commercial applications are pictured. Includes data on construction and operation as well as specifications.

Bettcher Manufacturing Corp.

**201—Industrial Space Heaters**

Twelve-page bulletin describes OG-581 new design space heater. Gas, oil, or combination dual fuel burners with push-button changeover. Output from 280,000 Btu/h up. Rugged construction with completely enclosed burner adaptable for space heating, ventilation, make-up air, process heating, air conditioning.

Lennox Industries Inc.

**202—Bifurcator Fans**

Catalog DB-37-55, 16 pages, describes operation of the bifurcator fan, a split-housing fan that exhausts hot, corrosive, and flammable fumes. Use of the bulletin makes fan selection easy since it gives full data on fan laws and static pressure, velocity pressure, and friction.

*DeBothezat Fans, Division of
American Machine & Metals, Inc.*

**203—Warm Air Heaters**

Bulletin 43-4-3 describes Wanson Corporation's *Thermobloc*, a leading warm air heater. *Thermobloc* is a packaged heating unit, completely self-contained. Various models produce heat output from 300,000 Btu/hr to 1,250,000 Btu/hr. Specifications, dimensional drawings and photographs included.

Wanson Corp.

**204—Air Make-Up Units**

Bulletin 880 describes and illustrates Aerovent's gas-fired and steam or hot water air make-up units for roof or wall type mounting in various capacities and pressure conditions. Also included is design, control and application data with additional information on filtered air supply and air heater units.

Aerovent Fan Co., Inc.

**205—Heavy Duty Blowers**

For easier selection of Class I and II forward curved blowers, catalog section 402 furnishes engineers with complete information on performance, dimensions, drive arrangements, fan and motor positions plus notes on applications. Illustrated with diagrams and photographs.

*Utility Fan Corp., Division
Utility Appliance Corp.*

**206—Heat Pump Systems**

Bulletin AC 451, a guide to pre-engineered air-to-air and air-to-water types of applied heat pump systems for commercial and industrial requirements. Describes the 4 basic heat pump types available which offer maximum latitude of design. Charts assist selection of components for proper range of capacity.

Carrier Corp.

**207—Gravity Roof Ventilators**

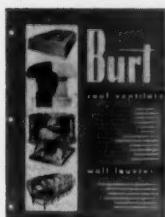
Completely new 8-page Bulletin PAR-59 describes in detail the *Pul-Air* ridge continuous gravity roof ventilator. Contains intricate drawings on mounting variations, damper types and operation. Listed are standard sizes, weights, and accessories. Actual installation photographs are included.

Penn Ventilator Co. Inc.

To order personal copies of these bulletins file

DIRECTORY OF ADVERTISERS' LITERATURE

HEATING & VENTILATING EQUIPMENT continued



208—Condensed Ventilator Data Book

Burt's complete line of power and gravity ventilators and wall louvers are described and illustrated in concise form in engineering bulletin SPV-10II. Important technical data, design, construction, capacities, performance, and dimensions are provided for each type. Cut-aways show operation.

Burt Manufacturing Co.



209—Steam Generators

Bulletin AA-1-75910M describes the new low pressure air atomizing oil burner and new ring type gas burner. Provides more uniform flame pattern, burns cleaner, and provides more efficient combustion. Model AA Amesteam generators operate at top efficiency over a modulation range of 20% to 100% of rating.

Ames Iron Works, Inc.



210—Low Profile Roof Ventilators

The new CKV Statick power roof ventilators are described in new Bulletin 59 SP. Engineered with low profile feature to meet modern roof line demands. Wide range of sizes with job-matched ball bearing motors. Features of ventilator are shown in cutaway photograph. Dimensions and capacity ratings.

Hirschman-Pohle Co., Inc.



211—Quiet Operating Fan

The AcoustaFan, which features a Flow-Nozzle air foil wheel designed specifically for quiet operation, is described in Bulletin 592. Quiet zone selection tables make an automatic selection of the quietest possible fan. Capacities range from 6000 cfm to 220,000 cfm, static pressure 3 in. wg through 11 in. wg. *New York Blower Co.*



212—Compact-Type Steel Boilers

Catalog SB107 gives new SBI ratings and engineering details on the Burnham Compact-Type steel boiler. Designed to compress maximum heating capacity into minimum floor space. It is available for oil, gas, and coal firing. Capacities from 2,930 to 39,370 sq ft SBI net steam EDR new ratings. *Burnham Corp., Steel Boiler Department.*



213—Radiant Panelbloc Heaters

Bulletin PE1-59 contains a wealth of information on infra-red heating application and is vest pocket size. All information necessary to engineer a Panelbloc installation for both full and spot heating is shown in clear and concise form. Includes pipe sizing for all gases and common heat loss factors. *Panelbloc Div., Bettcher Mfg. Corp.*



214—Hot Water Pumps

Bulletin 1400.8 describes *Heatemp* pumps, a patented and exclusive design feature used in a series of base-coupling mounted end suction centrifugal pumps with water-cooled pedestals and seals, for hot water circulation in heating systems. Multi-colored drawing shows heat-transfer system. Engineer's specifications. *Pacific Pumping Co.*



215—Propeller Fan Unit Heaters

Details on a new line of Dunham-Bush unit heaters for both steam and hot water applications are given in Bulletin 1301-B. Cutaway drawings show construction features of both vertical and horizontal types. Capacity data, conversion factors, and typical piping arrangement diagrams are presented.

Dunham-Bush, Inc.



216—Heavy Duty Blowers

Catalog section 401 includes complete information on backward curved class I and II heavy duty blowers. Performance tables, dimensions, drive arrangements, fan and motor positions, normal and special installations are all detailed to make engineering selection easier.

Utility Fan Corp., Division of Utility Appliance Corp.



217—Vaneaxial Fans

Bulletin 450 covers belt-driven vaneaxial fans for maximum efficiency against resistances to 7" sp. Specially designed propellers and guide vanes overcome swirl and turbulence to provide a high-velocity straight-line air discharge. Engineering data on units from 12" to 60" diameter, capacities to 74,860 cfm. *Aerovent Fan Co., Inc.*



218—Gas Duct Heaters

Bulletin GSD-591-WA5 describes Lennox GSD1 duct heaters with two stage control. Adaptable for space and process heating, ventilation, air conditioning, and make-up air. Output from 120,000 through 420,000 Btu/h. For larger heating outputs these extremely compact units can be grouped in a small space. *Lennox Industries Inc.*



219—Power Roof Ventilators

Bulletin 680-C describes Sky-Blast power roof ventilators. Weatherproof features include corrosion-proof, aluminum alloy propeller; nonclogging, dampers and rain-shed; one-piece all welded base hot-dip galvanized after fabrication. Automatic fire-vent release. Sizes to 60 inches; air deliveries to 78,000 cfm. *Robbins & Myers, Inc.*

HEATING & VENTILATING EQUIPMENT continued

**220—Fans and Blowers**

Catalog 240 outlines commercial and industrial fans and blowers manufactured by the Peerless Electric Co. Exhaust fans, blowers and roof ventilators, centrifugal roof ventilators, and utility blowers are described. Dimensions and performance data included. All products are illustrated. Sales representatives listed.

Peerless Electric, Div. of H. K. Porter Co.

**226—Roof Ventilators—All Types**

Catalogue 60 describes our standard types power and gravity roof ventilators featuring AMCA certified ratings for our *Statik* power ventilators. Nearly all the standard items shown are subject to considerable modification to meet your special conditions. Line drawings, cutaways, dimensions, and specifications.

Hirschman-Pohle Co., Inc.

**221—Thermobloc, Air Heating Units**

Bulletin SP-12-59 describes Wanson Corporation's air heaters available for oil, gas, gas/oil, and natural gas/LP gas firing. Features of heating units, blower assemblies, and controls are listed and described. Complete specifications are included. Line drawings show dimensions and area needed for installation.

Wanson Corp.

**227—Recirculation Generators**

Basic advantages of the Type LFW forced recirculation generators for high temperature water are given in ten-page bulletin 700. Chart compares capital investment, operating costs, and maintenance and repairs for high temperature water and high pressure steam for district heating from central plant.

International Boiler Works Co.

**222—Four Popular Ventilators**

Bulletin WRP-59 describes four types of Swartwout ventilating units, *Fiber-Aire*, *Contouramic*, *Pyrojector*, and *Heat Valve*. Cutaways show construction and operation. Performance and dimensional data, capacity tables, suggested specifications, and accessories included. Completely illustrated with line drawings, photographs.

Swartwout Fabricators, Inc.

**228—Heavy Duty IPL Fans**

Heavy duty industrial IPL fans that range in capacity from 4000 cfm through 154,000 cfm with static pressures to 12" wg are described in Bulletin 572. Sturdy all-welded construction and easy maintenance features make these fans ideally suited to severe industrial air moving applications. Illustrated.

New York Blower Co.

**223—Hot Water Boilers**

Bulletin HCC-2, a 20-page brochure, describes and illustrates the design, construction, advantages, and economies of the C-E LaMont controlled circulation hot water boiler for supplying high pressure, high temperature water for heating systems and process applications. Comparison table of heat content.

Combustion Engineering, Inc.

**229—Low Silhouette Ventilators**

Twenty-page technical manual contains helpful information in planning ventilation for commercial, industrial, school, and institutional buildings. Lists a complete line of low-silhouette, all-aluminum ventilators in capacities to 38,350 cfm. Also includes a new prefabricated curb for roof ventilators, in 12 sizes.

Loren Cook Co.

**224—Surface Unit Heaters**

Catalog 956 describes *Grid* cast iron steam heat transfer surface unit heaters, blast heaters, and radiators. Describes and illustrates one-piece construction. Included are air distribution charts, heating capacities, conversion tables, and specifications. This four-section catalog with tab index is well illustrated.

D. J. Murray Manufacturing Co.

**230—Aluminum Centrifugal Ventilators**

Twenty-five basic selections of tip speeds and capacities in direct drive models and sixty-four in V-belt drive models of Burt's new low contour spun aluminum centrifugal fan ventilators are detailed and illustrated in new engineering bulletin SPV-12. Page from the book shows detailed type of information.

Burt Manufacturing Co.

**225—Ready-To-Run Fan Sets**

Catalog 517 describes a new line of V-belt driven *Ready Units*. Features of construction and available special features are outlined. Selector charts indicating volumes to 25,000 cfm and static pressures to 2½ in. are shown in charts and graphs. Dimensions, capacities, shipping weights, and motor limits included.

Clarage Fan Co.

**231—Scotch-Type Packaged Boilers**

The Burnham scotch type packaged boiler incorporates a proven design with performance and capacity-tested boiler and burner for oil, gas, or combination gas and oil firing. Shipped as a complete unit, it is available in 8 sizes, certified ratings from 4740 to 12,750 sq ft EDR steam. Engineering details given.

Burnham Corp.

DIRECTORY OF ADVERTISERS' LITERATURE

HIGHWAY, BRIDGE & STREET MATERIALS



232—Steel Lighting Poles

Bulletin LS-9 presents new designs and data covering steel *Monotube* lighting poles for streets, highways, parking lots, shopping centers, and other locations. Poles are engineered for properly mounting today's modern luminaires. Similar information available in Bulletin LS-30 covering aluminum poles.

Union Metal Manufacturing Co.



233—Welded Steel Grating

New eight-page illustrated bulletin describes Gary welded steel grating and treads. Has easy-to-use table of safe loads, weights and symbols, and panel widths. Included is data on fastening devices illustrated by drawings. Information on specifying grating and treads.

*Rockwell-Standard Corp.,
Grating Division.*



234—Suspension Bridge Data

Catalog D-943 contains technical data making possible preliminary calculations for comparative estimates between the suspension bridge and any other contemplated type. Includes formulas for determining cable and suspender lengths, cable tensions, erection calculations, and catenary formulas.

John A. Roebling's Sons Corp.



235—Traffic and Safety Equipment

This illustrated brochure describes Planet's new line of highway traffic and safety equipment. Included are overhead sign trusses, roadside directional signs, bridge railings, pedestrian overpasses, and the "Planoflash", a portable night construction warning signal that is more visible than those commonly used.

Planet Corp.



236—Metal Lighting Standards

Kerrigan's new multi-page, indexed catalog contains engineering data on steel and aluminum lighting standards for streets, highways, and bridges. Catalog contains photographs and diagrams, as well as complete specifications. Included is section on tests and charts and one listing modifications and accessories.

Kerrigan Iron Works, Inc.



237—Signal and Sign Supports

Catalog TE-1, 20 pages, describes different types of all-aluminum supports for traffic control signals and signs. Shows typical installations, detailed drawings, and complete specifications for vertical signals, horizontal signals, truss type sign spans, pedestals, sign supports, and bases. Also signal arrangements.

Pfaff & Kendall.



238—Highway Products and Services

Bulletin ADUCO-90-90811, a catalog which includes all products of United States Steel used in highway construction from grading to surfacing. Sections include products for construction equipment, drainage, bridges and bridge foundations, paving, safety equipment, and highway accessories. Well illustrated.

U. S. Steel Corp.



239—Aluminum Beam Guard Rail

Bulletin 72-11230 introduces Alcoa's all-aluminum highway guard rail system. Design details and dimensions are shown in blueprint-type drawings. Specifications include description, material, strength tables, interchangeable parts, and installation. Application illustrations in full color. Sales offices listed.

Aluminum Company of America.

HOTELS, RESORTS & PLANT SITES



240—Industrial Opportunities

A colorful new presentation of Colorado's industrial opportunities. Included are booklets on manufacturing, power, raw materials and resources, transportation, markets and labor, Colorado living, industrial site locations, state highway map, and full color recreation booklet. Up-to-the-minute data in portfolio form. *Colorado Department of Development.*



241—Point Clear, Alabama

Grand Hotel, Point Clear on Mobile Bay, Alabama, offers colorful booklet on the facilities they provide for the vacationer. An eighteen hole golf course has clubhouse with complete facilities for entertaining. Cruising, fishing dancing, tennis, and swimming for recreation. Exquisite cuisine and flawless service.

Grand Hotel.

HOTELS, RESORTS & PLANT SITES continued



242—Southern Convention Spot

Grand Hotel, with its adjacent Lakewood Golf Club, each year is host to numerous corporation board meetings and sales conferences, as well as to many smaller executive and golfing groups. For those desiring complete information we have a special convention kit. Delightful location, excellent cuisine.

Grand Hotel.



243—Chicago, Illinois

Folder describes the Acres Motel located at 5600 North Lincoln Avenue on U. S. Route 41 in Chicago Illinois. Accommodations for every taste—single rooms, double rooms, kitchenettes, and apartments. Rooms have individual temperature control. Fine restaurant, swimming pool, and TV. Close to shopping center.

The Acres Motel.



244—Birmingham, Alabama

Folder describes the facilities of Hotel Thomas Jefferson in Birmingham, Alabama. Rich, but unobtrusive, décor in luxurious suites is perfect for entertaining that special client. Completely air conditioned, TV, radio. Excellent meeting rooms make this hotel Birmingham's convention headquarters. Excellent food.

Hotel Thomas Jefferson.



245—Fort Lauderdale, Florida

Folder describes Rutger's By The Sea in Fort Lauderdale, Florida. Printed in full color, this folder shows deep sea fishing, swimming pool, relaxing areas, and beach facilities. Typical room, lounge, and dining room also shown. Nearby golfing, horse racing, Jai-Alai, and dog racing for entertainment.

Rutger's By The Sea



246—Galveston, Texas

Folder describes Hotel Galvez and Villa located less than one hour drive from Houston via super highway. Thirty mile beach, swimming pool, fishing, horseback riding, tennis and golf are offered for recreation. Completely air conditioned. Facilities of Moody Center available for conventions up to 3500 persons.

Hotel Galvez.



247—Mobile, Alabama

Folder describes Hotel Admiral Semmes located in Mobile, Alabama, the Azalea City and one of America's most interesting old cities. A warm and friendly atmosphere and accommodations offer the utmost in comfort and pleasure. Completely air conditioned, television and radio, automobile entrance.

Hotel Admiral Semmes.



248—Washington, D.C.

Hotel Washington offers relaxed living. You can drive right into the hotel, via the motor lobby entrance and private registration desk. Dress as you please, your privacy is assured. Smart cocktail lounge, sky terrace, beautifully decorated modern rooms, superb food. Heart of shopping and theatrical districts.

Hotel Washington.



249—Chicago, Illinois

Folder describes the Acres Motel located on U. S. Route 41 in Chicago, Illinois. A convenient location whether you are headed north, south, or west. A few minutes drive from Chicago's Near North Side and only twenty minutes from the Loop. Swimming pool, TV, fine restaurant, individual temperature controls.

The Acres Motel.

INDUSTRIAL PROCESSING EQUIPMENT



250—Platecoil

This bulletin, 59-PI, describes and illustrates the new Platecoil configuration. It contains pertinent information on construction, application, and advantages in heat transfer. Specifications, size, weight, and surface area of standard units are listed. Varied applications are pictured and discussed.

Tranter Manufacturing Inc.



251—Vibrating Dryers and Coolers

Catalog 953 describes the Jeffrey complete line of vibrating dryers and coolers, as well as packers, controls, and Waytrols. One section is devoted to basic drying principles. Various types are detailed and illustrated. Construction drawings and installation pictures. Sizes, capacities, power, and weights.

Jeffery Manufacturing Co.

To order personal copies of these bulletins fill in the coupon on page 24.

DIRECTORY OF ADVERTISERS' LITERATURE

INDUSTRIAL PROCESSING EQUIPMENT continued



252—Commercial Laundry Machines

Illustrated brochure shows complete line of Cook commercial laundry machines, including 37 x 30 gas-steam-electric dryer, 25, 50, 75, 100-lb. washers, 20" and 26" extractors. Features Washette supply injector and Key-Matic one-dial control for washers. Both timer and coin operated models. Complete specifications.

Cook Machinery Co., Inc.



258—Dutch Brand Products

Bulletin 74-49 describes products and services of Johns-Manville, Dutch Brand Division. Research and manufacturing facilities are detailed. Various products: tapes, sponge rubber, molded rubber products, adhesives and packing, sealing, and gasketing products are described and shown in illustration.

Johns-Manville, Dutch Brand Division.



253—Mills for Dry Grinding

Bulletin 17-C discusses the proper application and selection of Conical Mills, Tricone Mills, Cascade Mills, Rod Mills, Tube Mills, and Disc Roll Mills for dry grinding problems. It also describes various air classifying arrangements and shows a number of plant flow sheets, also mill auxiliaries. Fully illustrated.

Hardinge Co., Inc.



259—Materials Handling, Processing

Fully illustrated brochure 182, 36 pages, presents a report of R&S diversified services for coal and iron ore mining, steel mills, and railroads. It features materials handling and processing facilities; also ore beneficiation plants other than specialized coal preparation plants and fabrication in well equipped shops.

Roberts & Schaefer Co.



254—Multi-Zone Platecoil

Bulletin 159, 48 pages, completely describes new Multi-Zone Platecoil, covering styles, dimensions, specifications, and operational data. Methods of calculating heat transfer equipment requirements are outlined. Typical installations are pictured and described. Available on request.

Tranter Manufacturing Inc.



260—Equipment for Industry

Kennedy bulletin 59-E describes their complete product line: crushers, impact breakers, mills, screens, feeders, conveyors, rotary kilns, and accessories. Planning complete lime, cement, aggregate, and controlled density-granular materials preparation plants, pulverized coal firing systems, testing and research.

Kennedy Van Saun Mfg. & Eng. Corp.



255—Expansion Engines

Bulletin 3600 B1 describes Worthington's low temperature reciprocating expansion engines for cryogenic applications to minus 452F. These expansion engines are used to produce the low temperatures required to liquefy and separate gases. Bulletin furnishes cut-away sections, and other engineering information.

Worthington Corp.



261—Automatic Processing Machinery

Case History describes how the Lynch Corp., working with Wayne Candies, Inc., has solved the problem of mechanical handling, weighing, and packaging of hard-to-handle items. Detailed are machines for weighing and packaging bulk candies, automatic packaging for fragile candy bars, and peanut sorting.

Lynch Corp.



256—Process Piping Valves

New bulletin 115 covers some basic points to consider when selecting valves for process piping systems and emphasizes the many advantages and savings that can be made by the proper selection of valves to meet piping characteristics. Some typical process applications are also covered.

Hills-McCanna Co.



262—Jaw Crusher

Double toggle, heavy duty jaw crushers for tough, abrasive, high compressive strength materials are described in booklet 17B6369. Ratings from 250 to 660 tons per hr. Principle construction features are described, including use of anti-friction bearings to reduce power consumption. Dimensions and ratings.

Allis-Chalmers.



257—Butyl Rubber

Twelve-page, two-color bulletin describes in detail Butyl rubber. Many applications of this rubber that stays "alive" are pictured. Many comparison graphs show effect of heat aging, electrical stability, shock absorption, sound damping, tear resistance, abrasion loss, gas permeability, and low temperature flexibility.

Enjay Co., Inc.



263—Unigraph Wall Chart

Charting problems solved in seconds with new *Unigraph* wall chart by Art Metal Construction Co. Multi-colored *Unigraph* permits either continuous or broken line charting for production, inventory control, sales analysis, machine loading and many other applications in business and industry. Bulletin AD 2470.

Art Metal Construction Co.

INDUSTRIAL PROCESSING EQUIPMENT continued

**264—Commercial-Industrial Burners**

Bulletin 1255 describes fuel burning systems for heating, power, and process requirements. Air or air/steam atomizing burners and partial pre-mixing gas burners are described, burner arrangements illustrated. Fuel consumption ranges from 20 gph to 300 gph on oil and 3,000 cfm to 40,000 cfm on 1,000 Btu gas.

Orr & Sembower, Inc.

**268—Chemical Processing Equipment**

Bulletin MG-104 describes *Glasco* 778, the most corrosion resistant glass ever applied to chemical processing equipment. The new glass offers 75° higher operating temperature, and is more corrosion and thermal shock resistant than chemical lab glass. Includes glass-lined reactors and heat exchanger tubes.

Glasco Products, Inc.

**265—Process Equipment Preheater**

Brochure entitled "The Ljungstrom Air Pre-Heater for Process Equipment" describes the fuel economy possible with this regenerator. Table of comparative fuel and power costs and graph clearly show these economies. Explains how added furnace capacity gives increased production and higher quality.

Air Preheater Corp.

**269—Coin-Operated Automatic Washer**

Illustrated bulletin shows *Waschette* coin-operated 25-lb washer suitable for installation in coin stores, apartment buildings, housing projects, and other applications. Complete specifications and features. Stainless steel model pictured, but machine available in enamel, either white or colored.

Cook Machinery Co., Inc.

**266—Corrosion-Proof Plastic**

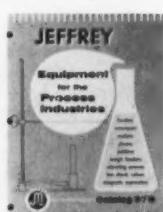
Maintenance-free *Duracor* resists practically any acid, fume, or gas. Strong, lightweight units requiring minimum support also offer integral resistance to heat or flame. Hoods, ducts, elbows, and other parts can be either supplied from stock or fabricated to individual customer specifications.

Ceilcote Co., Inc.

**270—Automatic Feeders**

Bulletin 33-E describes the complete line of Hardinge regulating feeders for continuous or intermittent feeding, including the Hardinge constant weight feeder, weight measuring feeder, volumetric belt feeder, disc or table type feeder, and volumetric non-flooding drum feeder. Well illustrated.

Hardinge Co., Inc.

**267—Process Equipment**

Catalog 978 describes vibrating feeders, conveyors, coolers, dryers, packers, weight feeders, screens, check valves, and magnetic separators. Each type of equipment is illustrated. Chart gives sizes, capacities, power, and weights of standard pan feeders. Line drawings show operation. Other equipment listed.

Jeffery Manufacturing Co.

**271—Self-Centering Rolls**

Bulletin ADUCO-78-78230 contains comprehensive material on the application and use of *Lorig-Aligner* self-centering rolls. This article by E. T. Lorig, chief development engineer for USS, includes operational diagrams and a description of rolls for centering and aligning metal strip on processing lines.

U. S. Steel Corp.

INSTRUMENTS and CONTROLS

**272—No-Freeze Liquid Level Control**

Bulletin R-31 describes and illustrates the new Magnetrol Model A-101 no-freeze winter-proofed liquid level control. Provides complete protection for outdoor water storage tanks. Bulletin includes advantages, operation, dimensions, specifications. Cutaway photograph illustrates the principle features.

Magnetrol, Inc.

**273—Portable Detectors**

Bulletin M1 describes Tinker and Rasor's portable detector for locating bare spots in thin protective films. Widely accepted in the corrosion control and industrial painting industry. It is non-destructive, applied voltage never exceeds 67½ volts. Bulletin furnishes specifications, operating data, and prices.

Tinker and Rasor.

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INSTRUMENTS & CONTROLS continued

274—Motor Controls

This condensed catalog lists, with prices, all commonly used motor controls up to and including size 4 rating. Standard enclosures are shown. Also included are various types of starters, transfer switches, control relays, push button stations, and other controls. Catalog is illustrated, includes list of renewal parts.

Allen-Bradley Co.



275—Pneumatic Control Systems

Bulletin M-101 explains the principles of pneumatic controls for heating, cooling, ventilating, air conditioning, and industrial processes. Controllers and controlled devices are shown in detail. Bulletin also covers typical applications ranging from simple thermostat-valve arrangements to complex dual-duct control systems.

Johnson Service Co.



276—Electronic-Pneumatic Systems

Circular 372 describes system which combines electronic measurement of temperature with pneumatic operation of the controlled device. Consisting of electronic sensors and an amplifier transducer unit which converts the electronic temperature signal to a pneumatic output. For duct, room, and outdoor use.

Powers Regulator Co.



277—Instruments for Industry

Bulletin 180 describes bulletins on various types of instruments for industry and instruments for laboratory and field testing, designed and manufactured by National Instrument Laboratories, Inc. Bulletin also lists representatives in the principle cities of the United States, Malton, Ont., and Victoria, Australia.

National Instrument Laboratories, Inc.



278—Fuel Cut-Out

Bulletin D2.5 describes a new device providing single or dual fuel cut-out control and low water level alarm if desired, is the Levalarm EA-100P. Cut-out can be controlled by a float-operated function or by an electrode set-up, or both may be used where dual cut-out facilities are prescribed.

Reliance Gauge Column Co.



279—Pressure Gauges, Needle Valves

Catalog 76-G, revised, covers all types pressure, vacuum, and compound gauges. Covers Master-test series of extremely accurate test gauges, Master-gauge series, Quality series, and Standard series, gauges covering all requirements. Also includes needle (throttling) valves. Ranges, types, and dimensions.

Marsh Instrument Co.



280—Solenoid Valves

Bulletin 506 new stock and selection guide lists the world's largest stock of solenoid valves for immediate delivery. Easy to select valve suited for your application. Valves are grouped under specific types—2-way normally closed, 2-way normally open; 3-way; 4-way; manual reset and special purpose.

Automatic Switch Co.



To order personal copies of these bulletins, please fill out the card between pages 2 and 3 or 58 and 59.

281—Dewpoint Indicators

Bulletin DPI-4 covers dewpoint indicator which determines water vapor content in gases by measuring dewpoint temperature. A primary measurement instrument, indicator gives accurate readings from ambient to -100°F. Portable battery-operated unit can check moisture content of dried air or gases.

Weighing & Control Components, Inc.



282—Specifying Guide for Tank Gauges

Form 632 is a specification guide especially designed in handy folder form to assist consulting engineers to specify their choice of tank contents gaging systems for each project. Contains sample specifications for hydraulic system, and hydrostatic systems (manually operated and continuous reading).

Liquidometer Corp.



283—Hydrostatic Indicators

New 88-page handbook prepared specifically for the convenience of consulting engineers. This book describes the complete line of hydrostatic liquid level and specific gravity indicators and controls, as well as accessory equipment. Includes discussion of the theory of hydrostatic measurement and engineering data.

Petrometer Corp.



284—Gauge Pilot Positioner

Bulletin F-029-089 describes the U. S. Gauge Pilot Positioner. This instrument combines for the first time an indicating pneumatic controller with a valve positioner. Includes advantages, applications, operating principle, and dimensions. Illustrations show essential components and operating hook-up.

United States Gauge Division.



INSTRUMENTS & CONTROLS continued

**285—Glass Tube Purge Meters**

Bulletin TP-1-RM, illustrated, describes W&T purge meter line for purge, vent, bleed, and other applications. Available with 1½ in. or 3 in. scale, they will withstand toughest industrial use. Interchangeable parts. Suitable for flush panel mounting. Publication gives full technical data and complete specifications.

Wallace & Tiernan Inc.

**286—Instrument Valve Manifold**

Bulletin RI-1825 Supplement C describes the Yarway instrument valve manifold, providing a simpler and more dependable means of making connections to flow meters and level indicators. Shows how three valves (two for shut-off, one for equalizing) are combined in common body. Operation described. Yarnall-Waring Co.

**287—Recording Instruments**

Catalog section 43-450 describes weather-proof recording instruments for load and voltage survey. Includes type 45 recorder application data, design features, specifications, circuit diagrams, engineering features, prices, and ordering information. Suitable for switchboard, portable, or pole-mounting.

Westinghouse Electric Corp.

**288—Remote Temperature Control**

Bulletin 371 describes Powers transmitter-receiver systems for remote temperature control and indication. Typical applications and data on products such as thermal and vapor-pressure type transmitters for rooms and ducts, receiver-controller with direct or reverse action and temperature indicating gauges. Powers Regulator Co.

**289—Annunciator with Recorder**

Bulletin 102A describes Panalarm's Model RA standard annunciator system with a highly accurate built-in automatic recorder. Gives a dependable, precise record of your equipment's operations. Advantages including exclusive features, and specifications. Photographs show installation, components, and operation. Panalarm, Division of Panellit, Inc.

**290—Electrical Controls**

Engineering reference catalog 18A contains a complete line of standard Zenith electric controls and timing devices. Photos, diagrams, engineering data, and prices on automatic transfer switches, magnetic contactors, remote control switches, program clocks, automatic reset timers, cycle timers, and special controls. Zenith Electric Co.

**291—Air Conditioning Controls**

Bulletin 76-4569 covers Honeywell's new modularized approach to centralized operation for air conditioning systems. Shows how engineers build up complete Supervisory Data-Center from basic units and how Selectographic approach provides visual supervision and direct control of sub-systems. Specifications.

Minneapolis-Honeywell Regulator Co.

**292—Liquid Level Controls**

Bulletin F-4A describes Fisher displacement type pneumatic proportional and two-position liquid level controllers in iron, steel, or alloy constructions for pressures up to 2500 psi. Models also available for specific gravity and interface level control applications and as indicators and transmitters.

Fisher Governor Company.

**293—Resistance Temperature Detector**

Bulletin 3047 describes the Edison resistance temperature detectors — stable, accurate, fast, sensitive, and rugged. Comparisons are made between the old type detectors and the new. Reliable temperature measurement is vital to modern industry. Operating principle, history, and advantages are included.

Thomas A. Edison Industries.

**294—Automatic Metering System**

Bulletin FL-56 describes Hetherington & Berner's Fluidometer, an automatic batch metering system. Adoptable to practically any liquid measuring problem. Equally accurate with high or low viscosities, eliminating waste. Shown in photo and diagram are direct control, remote control, dual valve, and multi-valve systems. Hetherington & Berner Inc.

**295—Bi-Color Boiler Gauges**

Bulletin 2044-A describes "Multi-Port" bi-color gauge MP 1050 for boilers operating at pressures up to 1050 psig. Water always shows green and steam red. Vision slot divided into series of round ports. This permits use of small glasses and small mica which are stronger and less sensitive to thermal stress.

Diamond Power Specialty Corp.

**296—Portable Holiday Detectors**

Bulletin EP describes Tinker and Raser's portable damp-climate, pulse type, holiday detector for surfaces coated or wrapped with high electrical resistance material. Adoptable for use on both large and small diameter pipe as well as flat surfaces. Bulletin furnishes specifications, voltage range, components. Tinker and Raser.

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DIRECTORY OF ADVERTISERS' LITERATURE

INSTRUMENTS & CONTROLS continued



297—"Oiltight" Control Units

This publication describes standard duty, heavy duty, and "oiltight" control units and stations applicable for every industry. Complete information on applications, ratings, and design features are included. All types of control units, stations, enclosures, and "oiltight" controls are shown and described.

Allen-Bradley Co.



298—Pneumatic Control Centers

Bulletin S-103 describes the functions, applications, and operation of centralized pneumatic controls for air conditioning, heating, and ventilating systems. The advantages of using pneumatic transmission are explained and the latest developments in control center instrumentation are shown in this 12-page booklet.

Johnson Service Co.



299—Gas Flowmeter

Catalog 178 describes mass flow primary elements of stainless steel construction for use in metering or controlling the mass rate of flow of gases. Complete metering-controlling systems are available for pressures up to 600 psig and flow rates up to 300 cfm or 1500 lbs./hr. Features and ordering information.

National Instrument Laboratories, Inc.



300—Eye-Hye Remote Gauges

Newly designed Eye-Hye remote gage for higher pressure is described in Sections C3.1B and C4.1D. Protruding reading medium permits observation of gage over 180° arc in front of panel. Complete description of three pressure-range model-groups, including dimension drawings. Fully illustrated with specifications.

Reliance Gauge Column Co.



301—Compact Solenoid Valves

Bulletin covers compact solenoid valves, Marsh Master-mite, in 1/8" and 1/4" sizes and ten orifice sizes, 3/64" through 1/4", pressures up to 540 psi. Used on air, water, petroleum products, coolant, oxygen, hydrogen, and acetylene. Underwriter's approved for use on oxygen and hydrogen and as safety valves.

Marsh Instrument Co.



302—Electromagnetic Controls

"Electromagnetic Control by ASCO," 180-page catalog 57-SR1, is indexed to provide an easy means of finding design engineering data on automatic transfer switches, remote control switches, contactors, relays, solenoids, electric plant controls, accessories, and special control equipment. Photographs and diagrams.

Automatic Switch Co.



303—Bulk Materials Controls

Automatic measurement and control of bulk materials through unitized weighing systems of pre-engineered components is the subject of catalog 12. The bulletin explains the application of a standardized system of instrumentation to batch and continuous weighing methods for a wide range of control purposes.

Weighing & Control Components, Inc.

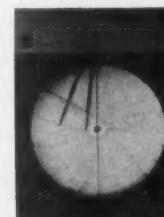


304—Tank Contents Gaging Systems

Suggested specifications for tank contents gaging systems — hydraulic, hydrostatic, and direct reading — are given in bulletin 463A. Model selection guides and pictorial diagrams are included, along with a list of liquids successfully gaged by Liquidometer systems, and principles of operation of each gage.

Liquidometer Corp.

To order personal copies of these bulletins, please fill out the card between pages 2 and 3 or 58 and 59.



305—Pen Recorders

Bulletin 3025 describes recorders, up to four pen, for temperature and pressure. New features include stainless steel escutcheon plate, largest chart and glass area in industry, dust ledges, epoxy resin finish, shelf which permits quick removal of capillary from wall or panel-mounted unit Ball-pivot movement.

United States Gauge Division.



306—Liquid Level Indicators

Bulletin 2004 describes and illustrates hydrostatic liquid level indicators for tank measurement of fuel oil and other fuels in buildings, commercial establishments, and industrial plants. Listed are distinctive features, principle of operation, and dimensions. Diagram details installation procedures.

Petrometer Corp.



307—Liquid Level Controls

Bulletin R-33 introduces the new non-metallic Magnetrol liquid level controls. Two models, NM-1 and NM-2, are featured. Describes applications of new non-metallic controls where liquids cannot tolerate the contamination of metals. List such liquids. Parts of controls in contact with liquids made of poly-vinyl.

Magnetrol, Inc.

INSULATION & PROTECTIVE COATINGS

308—Coal Tar Protective Tape

Hot coal tar protection in easy-to-apply tape form for pipe, pipe fittings and joints, conduit, cable, insulated pipe, tie rods. Material is heated lightly to soften the pitch, then spirally wrapped onto pipe surface. Tapecoat provides long-life protection that is equivalent to a hot-applied coal-tar pipeline coating.

Tapecoat Co.



314—Pipe Insulation News

News magazine, published by the manufacturer of *Gilsulate* insulation for underground hot pipes, carries stories and articles on actual installations. This issue describes installation at Seward Park Housing Development and uses of leapfrog forms when insulating with *Gilsulate*. Photographs and diagrams.

American Gilsonite Co.

309—Asbestos Insulation

Engineering manual F76-321 gives detailed information on Union Asbestos & Rubber Company's *Unibestos* pipe insulation. Precision production methods and rigid quality control described and pictured. Important advantages, installation photographs, comparison charts, application methods, and technical data.

Union Asbestos & Rubber Co.



315—Foamsil Insulating Material

Bulletin FS-1 describes Foamsil, a new insulating and refractory material. Contains background information on this new material, which is 99% pure fused silica and has a practical operating range of -450 F to 2200 F. Material is unaffected by practically all commonly used acids. Physical characteristics outlined.

Pittsburgh Corning Corp.

310—Stay-Dry Insulation

Bulletin FI-107 introduces *Stay-Dry* insulation for commercial applications from +35°F to +350°F. Contains illustrations of features, application specifications, suggested *Stay-Dry* thicknesses, available sizes and thicknesses for iron pipe and copper tubing, and a list of *Foamglas*' physical properties.

Pittsburgh Corning Corp.



316—Long Textile Insulation

Revised catalog ULD describes the use of *Ultralite*, the long textile type insulation for duct wrap and duct liner. Characteristics of *Ultralite* duct liner, together with application methods, are listed. Facings available, including new gray fire resistant coating, shipping information, and specifications are given.

Gustin-Bacon Manufacturing Co.

311—Silicone Insulation

Motors and transformers insulated with silicones are the subject of this 8-page cartooned brochure 10-120. Sketches show why maximum reliability is attained with minimum maintenance, size and weight of equipment are reduced, production can continue despite overloads as a result of silicone insulation.

Dow Corning Corp.



317—Insulation Specifications

Newly revised illustrated catalog IN-128A covers wide range of insulation applications specifications for petroleum, chemical, and steam generating plants. For optimum heat saving, better control of process temperatures, safety of personnel, equipment. Dimensions and properties are given.

Johns-Manville.

312—Pipe Insulation

"G-B Snap-On Pipe Insulation," eight-page booklet, describes characteristics and application data for one piece, fine-glass pipe insulation. Application specifications cover: plumbing, heating, insulation of valves and fittings, cold piping, dual temperature, and outdoor piping. Thickness charts are also included.

Gustin-Bacon Manufacturing Co.



318—Pipe and Block Insulation

Preliminary data sheet describes Union Asbestos & Rubber Company's U-200 *Urethane* rigid foam pipe and block insulation. Complete physical characteristics are given. Results of a four hour immersion tests in various chemicals included. Suggested thickness for pipe and block at varying temperatures.

Union Asbestos & Rubber Co.

313—Gilsulate Applications

Illustrated booklet S-88 gives the complete story of *Gilsulate*; what it is, what it does, how it's used, and who uses it. Booklet explains installation procedures and insulating values. Also tells of the organization in back of *Gilsulate*—checking of piping layouts and soil conditions and supervision of actual installations.

American Gilsonite Co.



319—Protective Coating

Tapecoat X is a coal tar protective coating in tape form for pipe, pipe fittings and joints, conduit, cable, insulated pipe, tie rods. Material is heated lightly with a torch, then wrapped onto pipe surface with one-half inch overlap. Provides protection on underground pipe equivalent to hot-applied coal tar.

Tapecoat Co.

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INSURANCE



320—Salary Insurance Report

A reprint of a report, which appeared recently in a monthly publication for management consultants, describing this relatively new form of group insurance that is rapidly growing in popularity. It includes six case-history reports on various types of firms, and how this insurance helped solve their problems.

Continental Casualty Co.



321—Salary Insurance

Bulletin CA-16928 describes the Continental Casualty Company's salary insurance group plans. This protection is available to firms employing five or more persons. Many points of specific interest to employers are covered. This bulletin also contains an open proposal form which can be used for price quotation.

Continental Casualty Co.

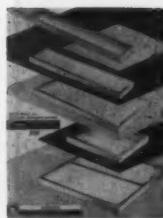
LIGHTING FIXTURES & ACCESSORIES



322—Lighting Application Data

Bulletin B-7253 contains basic recommendations and technical data for lighting applications for expressways or freeways; major arterial streets and rural trunk highways. Includes considerations and lighting requirements expected to exist by 1970. Valuable to consultants working on highway outdoor lighting.

Westinghouse Electric Corp.



326—Surfaceline Luminaires

Catalog Section 1, Pages 25 through 36, describes Miller's commercial Surfaceline fluorescent luminaires. These shallow fixtures, with hinged doors, come in sizes 1' x 4', 1' x 8', 2' x 2', 2' x 4', and 4' x 4'. Outline dimensional drawings, specifications, application data, illumination calculations, and features.

Miller Co.



323—Recessed Incandescent Fixtures

Colorful new brochure 31 describing Lightolier's line of recessed incandescent downlighting, just released. Construction features are detailed with special emphasis on the exclusive Duo-Style trim flange, the new Multi-Groove baffle, the Prismatek low brightness lens. Complete technical data and ordering information.

Lightolier Inc.

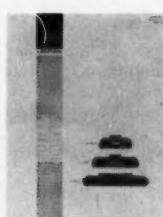


327—Rear-Lamped Floodlights

Bulletin 1097 describes and illustrates aluminum, enclosed type, rear-lamped floodlights for sports and industrial area lighting. Meet NEMA standards. For 750-1500 watt incandescent and 400-700 watt mercury vapor lamps. For cross arm, wall, pipe, and pole top mountings.

Steber Manufacturing Co.

Div. of Pyle-National Co.



324—Two Feet Wide Futurliters

Futurliter bulletin 44 includes pictures, descriptive details, engineering data, and installation information on new 2' Wide Futurliters. Also, complete data on companion Futurliter units in 12" and 17" widths. Futurliters feature either Grate-lite or Prismoid bottoms. Available in 4' and 8' lengths.

Edwin F. Guth Co.



328—Specifications Book

Two new RLM specifications for uplight porcelain enamel and aluminum incandescent units. Important revisions in RLM specifications are covered in 1959 edition of the RLM specification book. Changes include "all-white" incandescent reflector and 8%-20% uplight fluorescent specifications.

RLM Standards Institute.



325—Fluorescent Lamp Ballasts

Bulletin GET-922K gives installation suggestions and operating characteristics for GE fluorescent lamp ballasts. Contains chapters on starters, various types of ballasts, and equipment for dc operation. Photographs, line drawings and wiring diagrams are used to amplify the text. Service and sales locations listed.

General Electric Co.



329—Fluorescent Luminaires

Bulletin 61-150-7 gives a full description of the Mainliner fluorescent luminaire. This line offers seven different modular sizes with shieldings of different diffusers, lens, and louvers. Bulletin is illustrated with photographs and dimensional drawings. Detailed installation and application information.

Westinghouse Electric Corp.

LIGHTING FIXTURES & ACCESSORIES continued

330—Commercial-Industrial Fixtures

Bulletin V-810 describes a versatile line of commercial-industrial fixtures available for all lamp types, with several degrees of louver shielding, and in steel, aluminum, and plastic. Over 100 combinations provide ample selection for effective and economical direct-indirect lighting. Diagrams and pictures included. *Sylvania Lighting Products Inc.*

**331—Outdoor Package Lighting Units**

Bulletin LTC-30 describes a universal type of outdoor lighting fixture that comes complete with matching tapered aluminum post or davit standard. Can be supplied in incandescent, mercury vapor, or fluorescent. Specifications on various types of lighting given; posts and davits described; photometric data charted. *Pfaff & Kendall.*

**332—Emergency Lighting Systems**

Standard's new 20-page catalog 243A describes their emergency lighting systems. Besides fully describing these Underwriters' Laboratories approved systems featuring 100% electrical supervision, the new catalog contains information and specifications on all components, fixtures, and exit signs. *The Standard Electric Time Company.*

**333—Surface Mounted Fixtures**

Bulletin 61-150-6 presents a series of surface mounted units for ceilings in markets, stores, and corridors. The new stripliner luminaire is a highly efficient economy type unit where semi-direct, slim, smooth light is desired. Engineering data, dimension drawing, application, and ordering information. *Westinghouse Electric Corp.*

**334—Recessed Lighting Fixtures**

Bulletin OD-1036 describes the new UNI-FRAME Series of recessed lighting fixtures. Shows 24 combinations available for two box sizes. Fixture illustrations and drawings show application possibilities. Dimensional cross sections, design features and complete catalog listing are included in bulletin. *Day-Brite Lighting, Inc.*

**335—Fluorescent Ballast Distributors**

A revised list of electrical wholesalers who stock Advance fluorescent lamp ballasts is available in Bulletin 1201, Revised. Wholesalers listed stock popular Advance ballasts and will replace inoperative in-warranty Advance ballasts free of charge. The warranty policy of the company is explained. *Advance Transformer Co.*

**336—Ballast Application Guide Book**

Loose-leaf guide book GIZ-964 reviews the leading principles of ballast specification. Lists, by application, recommended ballast-lamp combinations with performance characteristics of appropriate General Electric ballasts. Gives prices, ratings, and general information. You will be billed \$5, including future revisions. *General Electric Co.*

**337—Surface Mounted Fixtures**

This new 24-page architectural brochure describes Lightolier's full line of surface-mounted fluorescent lighting fixtures: *Prismalux, Optiplex, Sightron, Modular Optiplex, Modular Strialux, Modular Sightron and Louvron*. Includes all technical, lighting, and installation data plus ordering information. *Lightolier Inc.*

**338—Fluorescent Lamp Ballast**

Bulletin B-1000, superseding B570-10, gives data and prices of Jefferson's fluorescent lamp ballasts. Included are wiring diagrams and complete specifications on rapid start ballasts of 60 cycle, normal power, and high power. Sound control chart helps you make the proper selection of lamp ballast. Characteristics. *Jefferson Electric Co.*

**339—Fluorescent Fixtures**

AD-6856 introduces a companion fixture to the popular Catalina series. General construction identical to Catalina except C-2 features a patented, low-brightness, polystyrene lens in place of the Catalina louver. Designed to blend into the latest architectural decor with its flowing lines of light. *Benjamin Electric Mfg. Co.*

**340—Recessed Downlights**

Engineering data sheets describe installation of recessed downlights in poured concrete structures. Housing treated to withstand corrosive effects of wet concrete becomes permanent part of structural member. Electrical connections in cast aluminum splice compartment permit thru-wiring with 60° circuit wire. *mc Philben Lighting, Inc.*

**341—Commercial Lighting Fixtures**

Catalog 61-320 introduces a new series of commercial lighting fixtures for service station, sports field, shopping center, parking lots, underwater, mine, general purpose or heavy duty needs. The bulletin includes fixture photographs, special features, descriptive data, price lists, and accessories available. *Westinghouse Electric Corp.*



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LIGHTING FIXTURES & ACCESSORIES continued



342—Fluorescent Lights

Bulletin 61-150-1 describes the complete line of LC fluorescent Carousel luminaires. Colored metal side panels and louvers diffuse a soft, smooth wash of light emphasizing specific colors without repelling others. Contains descriptive data, dimension drawings, application and ordering information.

Westinghouse Electric Corp.



343—Non-Combustible Diffusers

Bulletin 45 describes the new Guth NC (non-combustible) *Gratelite* louver diffuser for overall electric ceiling lighting. NC *Gratelites* are UL Listed as non-combustible and available in new 2' x 2' modules. *Gratelites* are molded of a non-combustible plastic with $\frac{1}{8}$ " open cubes. Layout and installation data.

Edwin F. Guth Co.



344—Fluorescent Units

A new economy unit with designed to meet high lighting standards of modern classrooms, offices, stores and other commercial establishments. Available in either 35° x 25° or 45° x 45° units in 2 or 4 lamp arrangements. Bulletin AD 6888 furnishes full installation details and construction specifications.

Benjamin Electric Mfg. Co.



345—Illumination Engineering Guide

Especially designed by mc Philben to assist consulting engineers in calculation of illumination by lumen and point-by-point methods and lighting layouts. Folio 59-2 contains a calculation guide, new IES lighting recommendations, lamp data, room indexes, and coefficients of utilization of mc Philben units.

mc Philben Lighting, Inc.



346—Sealed Beam Lamp Specifications

Bulletin 1098 is a sealed beam lamp specification guide. Lists over 200 popular *Steberlite* cluster combinations, each assigned single catalog number to facilitate specifying and ordering. Chart to simplify estimating number of lights required for lighting any area given.

*Steber Manufacturing Co.
Div. of Pyle-National Co.*



347—Fluorescent Luminaires

Catalog Section 1, 12 punched pages describes Miller's 2- and 4-lamp *Richmond* fluorescent luminaires for commercial and municipal applications. Available in 4 and 8 ft fixtures, with rapid-start, slimline, or high output lamps. Specifications, illumination calculations, and application data. Features pictured. *Miller Co.*



348—Industrial Lighting Levels

New, Illuminating Engineering Society's "Recommended Industrial Lighting Levels" are made available in pamphlet form by the RLM Standards Institute. A reference must for those concerned with planning lighting or re-lighting projects of industrial plants, utilitarian locations, and other facilities.

RLM Standards Institute.



349—Fluorescent Lighting Fixtures

Bulletin OD-1030 describes the *Fairview*, a new fluorescent lighting fixture with the first full 8-foot prismatic enclosure. Tells about new X-5 plastic and *Cleartex* diffuser. Includes illustrated features, photometrics, catalog and installation data. The bulletin is fully illustrated in natural color.

Day-Brite Lighting, Inc.

MATERIALS HANDLING & STORAGE FACILITIES



350—Trackmobile

Bulletin 245 describes in four full-color pages the important role played by a Whiting *Trackmobile* and a unique Whiting radial transfer table in the operation of Union Tank Car Company's unusual circular maintenance shop. Full description of the shop shows why it is considered one of the most advanced. *Whiting Corp.*



351—Feedrail Conveyor Systems

Bulletin 60 describes 60 ampere Feedrail. This system is made up of standardized units, factory assembled for easy installation. Advantages are outlined. Design and construction are shown in cutaway photographs. All products, including accessories, are illustrated. Typical layouts and installation procedures. *Feedrail Corp.*

MATERIALS HANDLING & STORAGE FACILITIES continued

**352—Vacuum Handling Systems**

Six-page, two-color bulletin V-100 describes Whiting *Pressuregrip* vacuum handling systems, newest contribution to efficient materials handling. Closed vacuum system quickly and safely handles a great variety of products, cuts costs. Gives specifications and suggests a few of the many possible applications.

Whiting Corp.

**358—Air-Float Conveyor**

Kennedy bulletin 58-K describes *Air-Float*, the air-gravity conveyor with the smooth, durable, porous tile conveying surface. Low pressure air, diffusing through the tile, nullifies friction. The dry pulverulent material flows down a 6° slope by gravity. No moving parts. All accessories available.

Kennedy Van Saun Mfg. & Eng. Corp.

**353—Building Elevators**

Catalog 534-C, a 20-page pictorial presentation in color, illustrates many important buildings equipped with Haughton Elevators. Office buildings, hospitals, hotels, apartments, industrial plants, and special-purpose structures are pictured. A complete listing of Haughton branch offices is included.

Haughton Elevator Co.

**359—Automatic Bulk Handling**

Bulletin 531, "New Techniques for Automatic Bulk Handling," is a 12-page report covering latest methods of pneumatic conveying. It details techniques for centralized automatic control, flow control, and bulk materials distribution throughout production. Installations are pictured.

Dracco Division of Fuller Co.

**354—Car Thawing Equipment**

Bulletin 168 explains the principles of infra-red heat rays and how they can be harnessed to melt frozen bulk material, thereby speeding up the unloading of railroad cars in wintery weather. Various applications are pictured and several case histories given. Features and specifications and different models included.

Hewitt-Robins, Inc.

**360—Materials Handling Facilities**

Fully illustrated brochure 182, 36 pages, presents a report of R&S diversified services for coal and iron ore mining, steel mills, and railroads. It features materials handling and processing facilities; also ore beneficiation plants other than specialized coal preparation plants and fabrication in well equipped shops.

Roberts & Schaefer Co.

**355—Monorail Cars**

Page reprinted from the St. Louis Post-Dispatch tells story of how monorail cars distribute merchandise in a St. Louis store. Shows how the CM *Telematic* electronically controls the flow of merchandise. Important destination points are pictured with explanatory captions. Layout of the system included.

Columbus McKinnon Chain Corp.

**361—Pneumatic Conveyors**

Spencer bulletin 143-B describes pneumatic conveying with stationary and portable systems. A typical diagram of each type is given; also a chart of approximate capacities and photographs showing various system components. Examples with illustrations of applications of pneumatic conveyors are shown.

Spencer Turbine Co.

**356—Overhead Traveling Cranes**

Bulletin 500A covers Conco custom-engineered overhead electric traveling cranes, of double girder construction. Can be furnished in a wide range of capacities and spans. Also included are hand-powered overhead traveling cranes, hand-powered and electric hoists.

*Conco Engineering Works,
Division of H. D. Conkey & Co.*

**362—Automatic Handling Systems**

Catalog 67-A describes, illustrates (photographs and diagrams) engineered and automated handling systems. The 16-page "Plan with Planet" brochure also illustrates equipment for bulk and unit materials, automated and special handling machinery, and foundry equipment, and describes Planet's creative service.

Planet Corp.

**357—Power Hoists**

Bulletin 34A, 20 pages, describes the Clyde line of electric, gasoline, and diesel hoists. Gives construction details of medium capacity hoists of various line pulls. Also includes information as to selecting the hoist, information required for hoist quotation, and table of drum cable capacities. Available accessories are listed.

Clyde Iron Works, Inc.

**363—Tank Designing Data**

This handy reference booklet contains tables of circles and spheres, area and volume formulas, decimals area and volume formulas, decimals of an inch and foot, tile shapes, standard reinforcing bars, wood pulp fiber in solution, capacities of tanks, conversion factors, and other information.

Stebbins Engineering and Mfg. Co.

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MATERIALS HANDLING & STORAGE FACILITIES continued



364—Lift Tray Elevator Conveyors

Case History describes how Lynch Robo-Lift tray elevator conveyors and bucket conveyors help move cartons for the C. F. Mueller Company, this nation's largest macaroni manufacturer. Gives problem, requirements, solution, and results. Conveyor lines are illustrated in photographs and line drawings.

Lynch Corp.



365—Overhead Handling Equipment

Automatic Electric Company's award-winning plant at Northlake, Illinois, utilizes Whiting *Trambeam* at a number of important areas. Four-page, full-color bulletin M-33 describes how this overhead handling equipment increases storage capacity, keeps materials moving at AE's efficient 35-acre installation.

Whiting Corp.



366—Custom Engineered Cranes

A new 12-page catalog covering in detail custom-engineered Conco overhead electric traveling cranes, including various bridge types and various electric trolley hoist types, as well as specially designed handling equipment employing crane principles and components. Illustrated with drawings and pictures.

Conco Engineering Works.



367—Materials Conditioning, Conveying

Bulletin G-3C describes Fuller rotary compressors, vacuum pumps, coolers, pre-heaters, blowers, fans, exhausters, and pneumatic conveyor systems for handling dry, pulverized, granular, and crushed materials. Illustrated with photographs and operational line drawings. Capacity and rating tables.

Fuller Co.



368—Materials Classifying Systems

Bulletin describes two types of classifying systems, both combining high efficiency with low power requirements and moderate cost. Units separate dry fine powdered or fibrous material from coarse within a fine product range of 10 to 400 mesh. Power requirements from 0.04 to 0.5 fan hp per ton of feed per hour.

Buell Engineering Co., Inc.



369—Vibrating Feeders

Bulletin 169 describes the *Eliptex* extra heavy duty vibrating feeder. This feeder is built to withstand severe battering in tough service involving unusually large and heavy materials. The advantages of this feeder are listed and the principle of operation explained. Standard specifications given and installations illustrated.

Hewitt-Robins, Inc.



370—Elevator Systems

Catalog SW-1 describes the complete line of Haughton Elevators, with special detailed information given on Haughton "Auto-Signematic" systems for complete automation of multiple-unit elevator groups. Includes recommended sizes and dimensions for passenger, freight, hospital elevators, and dumbwaiters.

Haughton Elevator Co.



371—Conveyor and Elevator Belting

Bulletin 170 describes C/R (cotton/rayon) conveyor and elevator belting. This belting is available in light, medium, and heavy duty, as well as chemical and fire resistant service. Comparison tests cotton/rayon versus cotton/nylon are given. Case history of C/R belt application. Specifics and advantages of C/R belting.

Hewitt-Robins, Inc.



372—Overhead Conveyors

Bulletin 159 describes *Power-Flex*, the CM power and free conveyor system. Construction and operating features of rail, chain, and trolleys are explained and pictured. Typical *Power-Flex* installation with *Telematic* dispatch control is diagrammed. Complete general specifications and customer service.

Columbus McKinnon Chain Corp.



373—Monorail Conveyors

Bulletin 75 describes in detail Feedrail Corporation's 100 ampere Feedrail. Features and advantages are outlined. Design and construction graphically illustrated with cutaway photographs. Catalog includes track sections, switches, trolleys, turntables, and accessories. Installation procedures included.

Feedrail Corp.



374—Car Pullers

Ten-page bulletin L-6 shows capstan type car puller for moving cars a short distance using manila rope. Three styles of drum car pullers for heavy duty car moving, shuttle work, or for servicing very large areas are also listed, as well as barge movers for shifting barges back and forth during unloading.

Clyde Iron Works, Inc.



375—Materials Handling Equipment

Sixteen-page, two-color bulletin 246 offers a definitive look at all Whiting materials handling equipment — overhead cranes, *trambeam* and *Pressuregrip* handling systems, and *Tracknobiles*. Fully illustrated, booklet describes many outstanding design features of each product and shows how each is being used.

Whiting Corp.

MECHANICAL POWER TRANSMISSION


376—Motor Reducer Drives

Fully illustrated booklet B-7223, 33 pages, includes recommendations, ratings, dimensions, and other application data to assist the consulting engineer in selecting the proper gearmotor or package motor reducer drive for his particular applications. Describes Moduline gear units for maximum adaptability.

Westinghouse Electric Corp.


380—All Types of Gears

A 20-page catalog describes in general the kinds and sizes of gears manufactured by this company. Its contents deal with spur gears, bevel gears, helical gears, worm gears, racks, nonmetallic gears, sheaves, sprockets, special machinery of which gears form a part. Illustrated with photographs.

Earle Gear and Machinery Co.


377—Gearmotors

Bulletin 51B9172 describes gearmotors available from $\frac{1}{4}$ to 100 hp. Bulletin covers integral and all-motor types including right angle as well as special designs. Allis-Chalmers complete line permits users and original equipment manufacturers to select just the right gearmotor for a particular need.

Allis-Chalmers


381—Speed Reducers

AA sixteen-page illustrated catalog, describing speed reducers as applied to operating machinery, particularly bridge machinery, is available. Outlined are specifications, service factors, horsepower ratings, and dimensions of the particular units illustrated. Gasoline power units are also dealt with.

Earle Gear and Machinery Co.


378—Turbine Pump Drives

Right angle turbine pump drives, in standard and combination drive installations and available in a wide range of models to meet specific requirements of high or slow speed prime movers and pumps, are described and illustrated in nine-page catalog 30. Tables show power ratings and average efficiencies.

Johnson Gear & Manufacturing Co., Ltd.


382—Magnetic Drives

Catalog 243 details the line of magnetic drives from Electric Machinery Mfg. Co. The drive is offered in 5 models from 10 hp to 300 hp. Complete with controls, the drives provide quick, smooth, ac speed changing. Automatic speed control is another feature. Complete selection data and charts are provided.

Electric Machinery Mfg. Co.


384—Lubricated Plug Valves

Bulletin PV-5 shows the full line of Powell steel and semi-steel lubricated plug valves, wrench and gear operated. The various types are illustrated in color, and available sizes, pressures, and complete dimensions are given. Accessories, lubricant recommendations, and maintenance suggestions included.

Hewitt-Robins, Inc.


383—Flexible Gear Couplings

Advantages and typical applications of flexible gear couplings are pictured and described in 16-page catalog C-5, "The Revolutionary New Sier-Bath Flexible Gear Couplings." Couplings are available in standard, vertical millmotor, floating shaft, spaced type, and in many special purpose types.

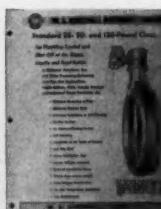
Sier-Bath Gear & Pump Co., Inc.

PIPING, VALVES, & PLUMBING SUPPLIES


385—Butterfly Valves

Bulletin 582 describes Rockwell butterfly valves, standard 25, 50, and 125 lb class, for throttling, control, and shut-off of air, gases, liquids, and semi-solids in processing, utility, and industrial applications. Features of this valve are described and pictured. Accessories are listed. Dimensions and specifications.

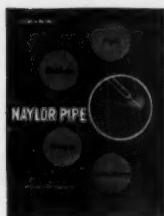
W. S. Rockwell Co.



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PIPING, VALVES & PLUMBING SUPPLIES continued



386—Lightweight Pipe and Fittings

New 8-page condensed catalog summarizes complete line of Naylor lightweight pipe, fittings, flanges, and connections. Lists typical applications. Includes standard specifications on pipe from 4 to 30 inches diameter, together with details on standard fittings and flanges. Covers couplings for pipelines.

Naylor Pipe Co.



387—Restaurant Water Coolers

Detailed specifications give varying capacities, installation details, and dimensional drawings for Haws self-contained restaurant and cafeteria water coolers. Accessories include filler faucets, glass racks, shelves, trays, and drip troughs. Compact space-saving units and optional height school units also shown.

Haws Drinking Faucet Co.



388—Eccentric Plug Valve

Dimensions and features of W-K-M's new eccentric plug valve are described in bulletin AE-1059-A. Ideal for sewage plants, waterworks, and industrial use. Available in sizes 2 in. thru 12 in., 150 lbs. CWP WP, wrench or gear operated. Plug has specially compounded rubber coating for positive sealing.

W-K-M Division of ACF Industries, Inc.



389—Steel Valves

Catalog 14 describes the complete Edward line of cast and forged steel valves for power, petroleum, chemical, marine, and industrial applications. Data includes ASA dimensions, ASA pressure-temperature ratings, and ASTM basic materials specifications.

Edward Valves, Inc., Subsidiary of Rockwell Manufacturing Co.



390—Electric Wall Fountain

Bulletin T-474 describes new "Wall-Temp" Model WT-13, completely self-contained, refrigerated, electric wall fountain, which mounts flush to wall and off the floor at any desired height. Fully concealed plumbing. Complete engineer's specifications and capacity ratings. Capacity 13 gph.

Temprite Products Corp.



391—Jointing Flexible Gaskets

Technical brochure describes and illustrates the use of "Tylox C" and "C-P" sewer pipe jointing flexible gaskets. Gaskets are for single or double offset pipe of all sizes. Diagrams show gaskets properly positioned and under full compression. Photographs show installation procedures. Coupling methods diagrammed.

Hamilton Kent Manufacturing Co.



392—Valves

Bulletin V-1 describes in condensed form the various types of valves manufactured by Schutte & Koerting. Outlined in detail are check valves, back pressure valves, reducing valves, butterfly valves, bypass valves, and instant-acting valves. Other S-K valves are listed. Line drawings show operation of various valves.

Schutte & Koerting Co.



393—Steam Specialties

Bulletin SS-140-C contains detailed data on Strong's extensive line of in-line steam traps, strainers, and pressure reducing valves. Applications, detailed specifications, list prices, and cutaway drawings are included, along with the wide range of fitting sizes, materials, and temperature and pressure capacities.

Strong, Carlisle & Hammond



394—Steam Traps

Bulletin 808-B describes the new 500-C series steam traps, combination open float and thermostatic type. Cutaway drawings show both thermostat and bucket operation. Photographs show accessibility of parts for service. Gives specifications needed for ordering. Includes capacities and specifications.

Wright-Austin Co.



395—Pyrex Glass Pipe and Fittings

Bulletin PE-3 is a manual for design, engineering, and installation of Pyrex brand double-tough glass pipe and fittings. Applications, advantages, physical characteristics, pipe, fitting, and accessories outlined and diagrammed. Engineering recommendations and installation data. Photographs and drawings.

Corning Glass Works.



396—Valve Catalog

This new valve catalog digest furnishes the latest coverage of the OIC bronze, iron, cast steel, forged steel, and lubricated plug valve lines in a condensed form. Classified by type and pressure class, and illustrated, this edition also includes face to face dimensions for each size and type of valve listed.

Ohio Injector Co.



397—Steel Fittings

Catalog H-1 provides information about the complete "Husky" line of low-pressure 150 lb. carbon steel fittings: straight tees, 90° elbows, 45° elbows, and reducers. Practical advantages of "Husky" fittings are included. Also shown are Schedule 40 and Schedule 80 high pressure specification tees. Specifications.

NIBCO Inc.

PIPING, VALVES & PLUMBING SUPPLIES continued

**398—Liquid Strainers**

Bulletin 6 deals with liquid strainers, single and duplex, for pressures from gravity to 900 psi. Capacities from 6 to 7500 gpm of water or 50 viscosity oil at 6 psi pressure drop. Mesh size 8 to 200, depending on liquid and contaminant. Strainer basket catches all contaminant; none is left in shell or piping.

William W. Nugent & Co., Inc.

**404—Nonlubricated Plug Valves**

Twelve-page catalog 581 GP contains specification of all sizes (1 to 4 in.) and pressures (1000 psi to 10,000 psi CWP) of Graham nonlubricated plug valves. Cutaway view shows construction details of this round port, full opening valve. Photos of all valves; parts lists; body and trim materials also included.

Texsteam Corp.

**399—PVC Pipe**

Revised edition contains new corrosion ratings, expanded information on thermal compensation, vacuum service, abrasion resistance. Installation and application sections have been enlarged. Diagrams illustrate joining of PVC to other piping materials. Includes dimensional data and working pressures for Schedule A tubing.

A. M. Byers Co.

**405—Pneumatic Valves**

Ilico Matic Valve bulletin V-159 describes new line of all plastic, pneumatically operated valves with integral piston type operators. Valves are recommended for automatic or remotely operated systems involving the handling of de-ionized or distilled water, or corrosive chemicals. Both open and closed.

Illinois Water Treatment Co.

**400—Ball-Type Flexible Struts**

Catalog 229A describes Barco's ball type flexible struts for refineries, power plants, chemical plants, paper mills, steel plants, and steam and processing piping. Cutaway photographs show construction and diagrams show dimensions. Included are engineering applications, advantages, capacities, and general specifications.

Barco Manufacturing Co.

**406—Water Works Brass Goods**

Water works brass goods bulletin WW-58 illustrates and describes McDonald water service products. Included are curb stops, corporation stops, goosenecks, meter stops and couplings, service pipe couplings, and extension service boxes. Each product offered is pictured with description and necessary specifications.

A. Y. McDonald Mfg. Co.

**401—Vitrified Clay Pipe**

Jointed vitrified clay pipe known as Amvit, with a built-in mechanical joint made from polyvinyl chloride, is described in four-page folder. Advantages such as infiltration prevention, quick installation, immediate backfilling, better flow, shock absorption, and quick testing in the field are pointed out.

American Vitrified Products Co.

**407—Air-Liquid Reels**

Bulletin AIR-259, a 6 page bulletin, listing 21 different types of air-liquid reels. Bulletin offers complete technical data and dimensions. All models fully illustrated, explanation of applications, hose sizes, lengths, and maximum pounds for working pressures are listed. For use with liquids, gases, and air.

Appleton Electric Co.

**402—Water Coolers**

This new 20-page, two-color booklet 892 describes the complete Ebcos line of water coolers. Emphasis is placed on this company's new cooler which furnishes both hot and cold water permitting the making of beverages. Features of the cooler are described in words and pictures. Booklet also describes accessories.

Ebcos Manufacturing Co.

**408—PVC Pipe, Fittings, and Valves**

Bulletin of engineering information on PVC plastic pipe, fittings, and valves. Specification, design, and installation information is included as well as a comprehensive corrosion resistance comparison chart for seven types of plastic pipe carrying 162 chemicals. Charts show fluid and gas flow characteristics.

Kraloy Plastic Pipe Co., Inc.

**403—Boiler Service Valves**

Bulletin E125, 22 pages, "Everlasting Boiler Service Valves," contains quick and slow opening straightway valves—Model W, angle valves, "Y" valves, duplex blow-off units, water column valves—Model W, and fire protection valves—opening and closing types. Includes a full page of material specifications.

Everlasting Valve Co.

**409—Jacketed Pipe and Fittings**

Bulletin J-57 describes pipe, welded steel fittings, spring loaded plug valves, and valves all jacketed, manufactured by Hetherington & Berner Inc. Different types of valves and fittings are illustrated together with cutaway photographs showing construction and operation. Also jacketed pumps and flexible hose.

Hetherington & Berner Inc.

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PIPING, VALVES & PLUMBING SUPPLIES continued



410—Bronze Valves

New circular shows 150, 200, 300-pound bronze valves that offer such advantages as: full flow with least pressure-drop and turbulence, 500 Brinell stainless steel seats and discs, long life, little maintenance. Can be furnished with indicator arm, collar, and V-port disc for accurate visual control.

Wm. Powell Co.



416—Pressure Sealing Gate Valves

Catalog 1200 describes W-K-M's new pressure sealing gate valves with unique double-action floating seats for positive seals both up and downstream. Through-conduit, stainless stem, slab-type gate, anti-friction bearings, and many other features are described. 2" thru 12", ASA 150 lb and 300 lb.

W-K-M, Division of ACF Industries, Inc.



411—Fabricated Pipe Fittings

Bulletin 525 illustrates standard and special fabricated fittings which help in planning piping and equipment layouts. Data includes specifications and prints on standard fittings for light-weight pipe. The bulletin also illustrates special fabrications designed to save time and labor.

Naylor Pipe Co.



417—Impactogear

Catalog 14-C describes the new "Impactogear," a ring gear and pinion assembly permitting a man with a portable power wrench to operate large cast steel globe valves without assistance. Can be fitted to any 10-, 12-, or 16-inch valve of 900 psi or higher pressure.

Edward Valves, Inc., subsidiary of Rockwell Manufacturing Co.



412—Wafer Butterfly Valves

Bulletin 583 contains information for easy selection of the valve needed for required pressure drop in the size and construction for air, gas, or liquid lines. Valves are pictured and diagrams show construction. Allowable pressure drop for Rockwell's seven classes of valves are charted. Control methods described.

W. S. Rockwell Co.



418—Entrainment Separators, Traps

Bulletin 811 describes and illustrates new Wright-Austin designs of entrainment separators and traps used for steam, compressed air, and gas applications. Also contains selection-capacity charts and data on air vents and strainers. Features of construction are enumerated and emphasized.

Wright-Austin Co.



413—Jet Apparatus

Bulletin J-1 describes the various kinds of jet apparatus manufactured by Schutte & Koerting for syphons, eductors, heaters, blowers, exhausters, compressors, scrubbers, condensers, pumps, and other types of equipment. Each application explained with cutaway drawings showing operation. Gives details.

Schutte & Koerting Co.



419—Pyrex Drainline Systems

Bulletin PE-30 describes Corning Glass Works' Pyrex brand lifetime drainline system, guaranteed against corrosion and leakage for the life of the building. Specifications, fittings, and sizes are shown in table form and diagram. Simple installation procedures illustrated and described. Distributors listed.

Corning Glass Works.



414—Drinking Water Facilities

Catalog 160 describes and illustrates with dimensional details Haws' latest and most popular facilities. Wall, pedestal, and deck-type fountains; single or multiple bubbler. Commercial and restaurant water coolers; wall-hung, standing, or remote. Also emergency eye-wash, eye-face-wash and shower equipment.

Haws Drinking Faucet Co.



420—Valve Comparison Chart

Bulletin 1012 is a OIC valve comparison chart, republished with up-to-date valve cross references. New features: breakdown on valve types by pressure class and design; federal specifications; valve trim cross reference chart; other valve manufacturers products cross referenced to OIC valves. Speeds up specifying.

Ohio Injector Co.



415—Hydro-Flex Steam Traps

Bulletin SS40B describes and illustrates Strong's complete line of semi-steel, cast or forged steel steam traps. Descriptions, specifications, prices, and methods of operation are included. Hydro-Flex traps are designed for high and low pressure services to 2500 psi and 1100°F. up to 150,000 lbs/hr.

Strong, Carlisle & Hammond.



421—Flexible Gaskets for Coupling

Technical brochure describes and illustrates the use of Hamilton Kent's "Tylox C-R" flexible gaskets for coupling recessed pipe of all sizes. Gaskets are of a special cross-sectional design to prevent distortion as pipe is coupled. Diagrams show how gasket works. Photographs show method of installation.

Hamilton Kent Manufacturing Co.

PIPING, VALVES & PLUMBING SUPPLIES continued

422—Valves

Dimensions and detail drawings plus a parts list are included in 20-page bulletin E-165. Bulletin discusses class 125 single and double disc, class 250, cylinder-operated valves, lubricated valves, valves for emergency protection, steam-jacketed valves, and valves for boiler blow-off. Fully illustrated.

Everlasting Valve Co.

**423—Pipe Fittings**

Catalog I presents the complete line of NIBCO wrot, cast solder, cast drainage, flanged, and flared tube fittings. It is a manual of technical information to help the consultant select fittings for copper tube installations. Included are rough-in measurements, advantages of using NIBCO fittings, engineering data. *NIBCO Inc.*

**424—Disc Liquid Filters**

Bulletin 7C, 16 pages, illustrates and describes the full line of crenulated laminated disc liquid filters for removing small micron-size foreign solids from most liquids in one pass through at a rate of 1 gpm at 1 psi pressure drop to 1260 gpm at 3 psi pressure drop, of 35 ssu viscosity fluid.

William W Nugent & Co, Inc.

**425—Double Disc Gate Valves**

Ludlow & Rensselaer bulletin A describes in detail double disc gate valves. Cutaway photographs show various parts and construction. Line drawings show the different types of valves with dimensions charted for each valve. Directions for ordering new valves and repair parts are given. Valves A.W.W.A. approved. *Ludlow Valve Manufacturing Co., Inc.*

**426—Glass-Lined Sewer Pipe**

Folder deals with the glass-lined sewer pipe with a mechanical joint. *Amott Glas-Glas* pipe is available in 4-ft lengths. It is root and infiltration proof and is glass lined inside and out. The pipe has been designed for an under-the-house drain and also as a house-to-street sewer.

American Vitrified Products Co.

**427—Drinking Water Coolers**

Bulletin T-472 describes complete line of self-contained drinking water coolers. Capacities from 3 to 27 gph; air-cooled or water-cooled condensing units. Includes new wall mounted type, explosion proof, stainless steel, hot and cold, and wall remote models. Complete specifications, capacities, and other data. *Temprite Products Corp.*

**428—Wrought Iron Pipe**

Comprehensive 64-page booklet discusses 4-D wrought iron pipe for downspouts, soil, waste, and vent lines. Includes sections on corrosive conditions, comparative service, Durham systems, cost considerations, and specifying data. Photographs of vent corrosion accompany two building piping surveys.

A. M. Byers Co.

**429—Flexible Ball Joints**

Bulletin 31A contains layout diagrams, photographs, and data on how to solve problems of thermal expansion and contraction in piping economically with flexible ball joints. Applicable to piping runs of any length and of any diameter from $\frac{1}{4}$ inch to 12 inches, including high temperatures steel piping. *Barco Manufacturing Co.*

**430—Cast Iron Pipe**

Catalog of cast iron pipe, fittings, fire hydrants, water works gate valves. Specifications, dimensions, and weights of ball and spigot, mechanical joint, flanged pipe, and fittings covered. *Mathews Modernized, Mathews Flanged Barrel, and R. D. Wood Swivel Joint fire hydrants described. Also Wood gate valves. R. D. Wood Co.*

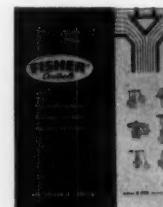
**431—Alloy Mechanical Tubing**

Bulletin TB-430, "How to Cut Cost by Using Alloy Mechanical Tubing," is issued by the Babcock & Wilcox Company. Folder discusses initial cost, structural advantages, types of steel, types of tubes, and procurement tips. Lists types of tubing manufactured by Babcock & Wilcox and the various sales offices. *Babcock & Wilcox Co.*

**432—Pressure Reducing Valves**

Bulletin C-89A describes Fisher pressure reducing valves, relief valves, lever valves, float valves, and strainers for automatic flow control of steam, water, air, gases, and process liquids. Charts covering size, specifications, dimensions, pressure ranges and ratings, and capacities are included.

Fisher Governor Co.

**433—Rubber Seat Butterfly Valves**

Bulletin 10J is a new catalog describing the new *Monoflange* Mark II rubber seat butterfly valve. The catalog has been designed to be the ideal working tool for engineers and users of this type equipment. Complete specifications, flow data, certified drawings, weights, freight rates, and prices are included.

Henry Pratt Co.



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PIPING, VALVES & PLUMBING SUPPLIES continued



434—Motorized Valve Actuators

Bulletin 5911 describes a complete line motor driven, geared power transmitters that automatically operate all types of valves and other rotating mechanisms. Explains complete operation. Gives dimension drawings and charts and lists complementary equipment.

*Helitork, Division of
Earle Gear & Machine Co.*



435—"Hot'n Cold" Water Coolers

Booklet entitled "How to cut coffee-break time in half" is offered by EBCO. This booklet describes the new Hot'n Cold water cooler with a beverage locker. Complete line of Hot'n Cold coolers are illustrated. Also shown in pictures are the various applications. Shown in chart form are possible yearly savings.

EBCO Manufacturing Co.



436—Insulated Piping Systems

The new edition of the Ric-wil product catalog covers construction features for prefabricated, insulated piping systems for steam, hot water, oil, or refrigeration distribution lines. Types of systems covered include *Hel-cor*, *Uniline*, *Type J*, and cast iron. Prefabricated accessories are also included.

Ric-wil, Inc.



437—Steam Traps

Catalog K, the Armstrong steam trap book, has been revised and expanded to 48 pages. New material includes complete data on Armstrong open float and thermostatic steam traps; strainers in $\frac{1}{2}$ to 6-inch sizes in semi-steel; new pipe size tables; and additional data on trap selection.

Armstrong Machine Works.



438—Surface Wash Water Valves

Bulletin W-17 describes valves specially made for surface wash water application on filters and for control of water flow to filters. Valves may be controlled from operating table by electricity, air, or water. There is no working against line pressure. Instead, line pressure against piston operates valve.

Golden Anderson Valve Specialty Co.



439—Electric-Welded Steel Tubing

This four-page brochure is printed in two colors and gives sizes, weights, and uses of Wheatland Electric-Welded Steel Tubing. Also checklist of ordering information. Covers hot- and cold-rolled mechanical tubing, pre-dipped and hot-dipped galvanized. Illustrated and printed on heavy durable stock.

Wheatland Tube Co.



440—Gravity Sewer Pipe

This new bulletin describes "K&M" asbestos-cement gravity sewer pipe with the exclusive, patented *Fluid-Tite Coupling*. Offers data on installation and operation plus information on infiltration tests, dimensions, and tolerances of pipe and couplings, and connections for joining pipe to building sewer pipe.

Keasbey & Mattison Co.



441—Cone Valves

Consultants concerned with valves for industrial application, power plants, and water and sewage works will find handbook 02B2555 a must. Discusses what type of valve to use where, and why. Selection data on a broad line of cone-type valves includes descriptions, performance curves and specifications.

Allis-Chalmers.



442—Gate and Check Valves

Catalog 57 describes Darling's line of gate valves and check valves in iron, bronze, steel, and special alloys for all types of valve application. Also included are fire hydrants and accessories for fire protection. This 244 page bound volume gives specifications; pictures facilities; and illustrates product applications.

Darling Valve & Manufacturing Co.



443—Snow Melting Systems

"Steel Pipe Snow Melting and Ice Removal Systems," 32 pages, presents the case for snow melting systems and shows typical installations in commercial and industrial locations. Design data is complete with information on anti-freeze mixtures, sizes, and spacing.

*Committee on Steel Pipe Research,
American Iron and Steel Institute.*



444—Impulse Steam Traps

Bulletin T-1744 describes the Yarway No. 30 impulse steam trap for extra light condensate load requirements, having pressure range 8 to 600 psi, with maximum temperature 750° F., and designed small enough to fit in hand. Lists materials, dimensions, weight, discharge capacities, applications, and prices.

Yarnall-Waring Co.



445—Vitrified Clay Pipe

Bulletin PS-101 describes Kaul Clay Company's *Presto SEAL* vitrified clay pipe. Socket and spigot ends are factory-molded polyester, with a rubber gasket permanently imbedded in the socket end. When socket and spigot ends of pipe are joined, a perfect, permanent, flexible seal is made in seconds.

Kaul Clay Co.

POWER EQUIPMENT & FUELS

446—Packaged Boilers

Catalog AD 137 describes the CB Progress and Monitor boilers. Advantages of four pass, forced draft design, oil, gas, or combination fired are described. Specifications, ratings, and dimensions are given as well as recommended boiler room layouts. Completely packaged units to fit every installation.

Cleaver-Brooks Co.

**447—Waste Heat Recovery**

Bulletin WHB 59-3 describes the economic utilization of excess heat developed from diesel exhaust gases and industrial and chemical processes. Specific industrial, marine, and chemical applications of varying capacities and services are illustrated. Advantages of bare tube and extended surface designs are noted.

Foster Wheeler Corp.

**448—Engines and Generator Sets**

Complete 80-page catalog includes power curves, sectional drawings, and subassembly photographs of six basic engines in 19 models, a power range of 100 to 2150 bhp. Diesel, gas, and dual fuel engines and generator sets are available as a custom installation.

*White Diesel Engine Division,
White Motor Co.*

**449—Packaged Gas/Oil Burner**

Bulletin BE-300 describes exclusive mechanical pressure atomizing oil and nozzle mix gas burner with which Continental automatic "package" firetube boiler is equipped. Three full-page wash drawings describe construction features and principle of operation of the compatible oil and gas burners.

Boiler Engineering & Supply Co., Inc.

**450—Stationary Engines**

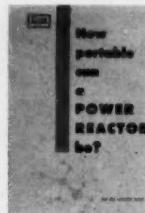
Bulletin SA-584-B describes Climax Blue Streak stationary engines, fueled by sewage gas, gasoline, Butane, or natural gas. For sewage treatment plants, standby equipment, generators, blowers, water pumps, ventilating fans. Advantages, specifications, performance curves, and dimensional drawings included.

Climax Div. of Waukesha Motor Co.

**451—Steam Generators**

Bulletin 59 describes Cyclotherm's steam generators. Standard ratings and dimensions include dimensions, weights, firing rates, and electrical load requirements. Standard burner arrangements with available equipment are completely outlined. Installation photographs.

*Cyclotherm Division
National-U.S. Radiator Corp.*

**452—Packaged Nuclear Power**

Booklet entitled "How Portable can a Power Reactor be?", written by John P. Tully, provides the answers to packaged nuclear power. Artist's conception shows Alco's packaged nuclear power plant installed. Line drawings show elevation and plan view of skid-mounted primary system package.

Alco Products, Inc.

**453—Water Separator Snubbers**

B/M "WSS" water separator snubbers are designed to extract 100% of the liquid water from water-sealed vacuum pump exhausts and simultaneously reduce noise of the gas discharge to an ear-comfort level. Used with water for cooling exhaust gases to a safe level where explosive substances are handled.

Burgess-Manning Co.

**454—Heating Boiler Safety Controls**

Bulletin P-30C describes basic safety controls for hot water space heating boilers. Six fundamental questions about safety valves are answered and each is illustrated with diagrams. One page is devoted to service recommendations showing cutaway drawings of various types of safety valves. Specifications given.

McDonnell & Miller, Inc.

**455—Automatic Packaged Boiler**

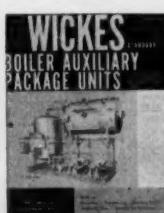
Specifications for application of IBW-BCR Coal-Pak automatic package boiler to low-pressure steam heating, hot water heating, and high-pressure process steam. For plant designs using one 71.6-hp unit to a multiple of 300-hp units. Sample specifications include coal and ash handling, wiring, and boiler room layouts.

Bituminous Coal Institute.

**456—Low-Level Economizer**

Bulletin 178 describes a low-level economizer specifically designed for low-temperature heat recovery. Extended-surface cast iron type utilizes a separate water circuit. This circuit transfers the recovered heat into the incoming combustion air to help protect the air heater surface while increasing overall efficiency.

Green Fuel Economizer Co., Inc.

**457—Boiler Auxiliary Packaged Units**

Bulletin 59-1 describes auxiliary package units available for boilers of 10,000 to 100,000 lbs steam per hour, steam pressure to 300 psig. Units have various combinations of deaerating feedwater heaters, boiler feed pumps, condensate surge tanks to reduce maintenance and to increase plant efficiency.

Wickes Boiler Co.

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POWER EQUIPMENT & FUELS continued

458—Commercial-Industrial Burners

Twenty-page catalog describes Petro commercial-industrial oil, gas, and dual fuel burners used for heating, power, and process steam requirements. Includes section on "How to Select a Burner." Illustrates several typical installations and various burners, from 8 through 200 gal per hr oil capacity. *Petro.*



459—Automatic Coal Firing Units

A compact, automatic coal firing unit for installations of 175 hp to 350,000 pounds of steam per hour and upward. Engineered for top efficiency with both low and high ash coals. Exclusive conveyor feeder won't clog and provides even distribution throughout entire range, 50 to 7500 lbs coal per hr. *American Engineering Co.*



460—Three-Pass Boilers

Bulletin B-3240 describes the Titusville Titan 3-pass units for power and heat. They are precisely engineered to meet the most exacting mechanical and thermal specifications. Mechanical and thermal features are listed. Illustrations show the boiler with various types of burners available. Certified results in chart form. *Titusville Iron Works Co.*



461—Atomizing Fuel Oil Burners

The Todd Vee-Cee type variable capacity mechanical atomizing fuel oil burner for installations with widely fluctuating loads is fully described in four-page bulletin TD56-16X. Bulletin shows special construction that gives uniform, easily oxidized spray, constant pressure and quick cold starting. *Todd Shipyards Corp., Products Div.*



462—Automatic Firing Equipment

Catalog 6260 describes the complete line of Iron Fireman commercial and industrial burners. Included is an "Index and Selection Chart" which enables users to select appropriate equipment based on type of fuel desired and kind of draft. Single or dual-fuel combustion equipment available. *Iron Fireman Manufacturing Co.*



463—Packaged Boilers

Catalog AD 167 packaged boilers and high temperature equipment, describes the Cleaver-Brooks line of boilers with unique hinged doors and fully automatic controls. Advantages of four pass, forced draft design, 5 sq ft of heating surface per boiler horsepower. Oil, gas, or combination fired units are described. *Cleaver-Brooks Co.*



464—Complete Packaged Boilers

Twelve-page catalog describes Type AS Superior packaged boilers for capacities from 4000 to 21,000 lbs steam per hr. Complete packages with rotary burners, integrated controls, soot blowers, refractory, and insulation, these units also have quiet rear mounted draft fan which provides air-cooling of furnace floor. *Superior Combustion Industries, Inc.*



465—Vented Deaerators

Bulletin 1300 explains simple, fully vented deaerator that assures positive, economical oxygen removal to .03 cc/liter from feed water, heating equipment, and return lines. Illustrates operating principle and components. For boiler plants with capacities from 1,000 to 30,000 lbs/hour. Representatives listed. *Fred H. Schaub Engineering Co.*



466—Power Engines

Bulletin 4331 B1 describes Worthington's newest power engine. Turbocharged, medium sized, 440 to 1100 hp, the SLHP is ideal for municipal, industrial, sewage, and public works power requirements wherever gas is available for fuel. Bulletin furnishes cutaway sections, dimensions, and other important data. *Worthington Corp.*



467—Induced Draft Bifurcator

Bulletin DB-44-56 describes DeBothezat's induced draft bifurcator, which provides instant, adequate draft eliminating costly stacks. Construction features are listed and illustrated with cutaway. Installation photographs, boiler code ratings, selection data, dimensional drawings.

DeBothezat Fans, Division of American Machine & Metals, Inc.



468—Jet Silencers

This 8-page bulletin describes Maxim jet silencers, portable, semi-portable, and stationary types for jet engine testing and run-up. It also describes Maxim sound barrier panels which have wide use in industry for sound-proof rooms, enclosures, and doors. Includes many illustrations and engineering drawings. *Emhart Mfg. Co., Maxim Division.*



469—Diesel Engines

Bulletin 40-20169 describes diesel engine power by Caterpillar. Includes specifications and illustrations of four-cycle diesels for any job, modern power plants with compact generators, and marine engines for continuous duty. Engines and attachments adaptable into engine packages for special needs. *Caterpillar Tractor Co., Engine Division.*



POWER EQUIPMENT & FUELS *continued***470—Hot Water Boilers**

Catalog AD 188 describes the Cleaver-Brooks hot water boilers. An engineering report on high velocity flow hot water boiler. Results of extensive laboratory experiments and field testing under actual conditions. Complete packaged units. Line drawings show internal flow and circulation patterns.

Cleaver-Brooks Co.

**471—Coal-Fired Packaged Boilers**

Bulletin PG-59-4 describes semi-automatic stoker-fired packaged boilers now available in standard sizes of 43,000, 50,000 and 63,000 lb of steam per hour. Performance characteristics are given in graph and table form. Photographs and line drawings of the water-tube units show installation and construction details.

Foster Wheeler Corp.

**472—Stationary Diesel Engines**

Bulletin 110 describes Models 60 and 80 *Superior* stationary diesels. Four-cycle, 6- or 8-cylinder, in-line models, ranging from 530 to 2000 bhp and from 300 to 1250 kw. Typical applications are water works, sewage plants, power plants, and others. Specifications given.

*White Diesel Engine Division
White Motor Co.*

**473—Automatic Boilers**

Bulletin BE-400 contains useful tabulated data on 35 models of Continental automatic "package" firetube boilers ranging from 15 through 600 hp sizes. Illustrated design specifications of the boiler itself and the integral burner and control system make the bulletin a helpful reference source for engineers.

Boiler Engineering & Supply Co., Inc.

**474—Burners**

Form 5808 describes light oil, gas, and dual-fuel oil-gas burner designed for operation against firebox pressure. Fires number 2 fuel oil and/or natural or LP gas. Special burner head produces high combustion efficiency and prevents flame pulsation. Models available for firing pressurized or natural draft boilers.

Iron Fireman Manufacturing Co.

**475—Gas and Gasoline Engines**

Bulletin SA-542-E describes the V-122 and the V-125 twelve-cylinder gas or gasoline engines manufactured by the Climax Division of Waukesha Motor Co. These engines develop a maximum of 520 and 610 horsepower respectively. Engines combine simple rugged construction with smooth running.

Climax Div. of Waukesha Motor Co.

**476—Packaged Steam Generators**

New six-page bulletin entitled "More Performance From Less Investment" describes in detail Cyclotherm's line of 18 sizes of package steam generators 15 hp to 650 hp. Also specifications, on 10 sizes of new package hot water generators, 670 mbh to 6700 mbh.

*Cyclotherm Division
National-U.S. Radiator Corp.*

**477—Heat Recovery Snubbers**

Bulletin 272 describes the Burgess-Manning line of heat recovery snubbers. Heat recovery up to 1500 Btu/bhp/hr can be obtained with a circulating water pump in the system. Standard 2-chamber snubber design plus reduction of gas volume by cooling provides a high degree of silencing.

Burgess-Manning Co.

**478—Steam Boiler Safety Controls**

Bulletin L-711 describes basic safety controls for low pressure steam boilers. Completely discusses closed heating systems and multiple boiler systems. Booklet is fully illustrated with diagrams of systems and photographs of the products. Schematic operation of McDonnell switches. Service recommendations.

McDonnell & Miller, Inc.

**479—Coal Storage Data**

Fuel Engineering Data Section D-3 describes in-plant and outside storage methods applicable to plants burning 500 to 100,000 tons of coal annually. Contains specific instructions on such items as stockpiling, compaction, handling hot coalpiles. Discusses equipment requirements based on tonnage stored.

Bituminous Coal Institute.

**480—Airfoil Fans**

Bulletin 179 describes Green's complete line of airfoil fans for forced and induced draft service. This line of fans features an extremely wide range of pressure-volume ratios at high efficiencies for all mechanical draft applications. Charts, tables, and application notes. Drawing shows wheel types.

Green Fuel Economizer Co., Inc.

**481—Rotary Oil Burners**

The new Todd Series B rotary fuel oil burners are summarized in four-page bulletin TD56-82X. It includes a burner size selector chart and lists 11 advanced design features of seven basic sizes rated from 400,000 to 22,500,000 Btu per hr, with oil capacity from 3 gal per hr to 150 gal per hr.

Todd Shipyards Corp., Products Div.



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POWER EQUIPMENT & FUELS continued

482—Diesel Engines

Bulletin DE-6 describes Alco 251 diesels. Available in three sizes, Six, Vee 12, and Vee 16 and ratings from 550 to 2400 hp. Cutaway of Vee model shown together with illustrations and descriptions of components. Diagrams of In-line 6, Vee 12, and Vee 16 with dimensions and specifications.

Alco Products, Inc.

251



483—Viscous Fluid Heaters

Bulletin 1.4K 1 describes heaters for viscous fluids. Type O is a standard straight tube preheater for fuel oils and similar fluids and Type TS is a standard tank suction heater for heavy fuel oils and other fluids of similar viscosity. Includes features, dimensions, diagrams, capacities, and fuel oil requirements.

American-Standard, Industrial Division.



484—Wormfeed Stokers

Bulletin 559 describes Canton's Duraflex wormfeed stokers for bituminous and anthracite coal. Included are specifications and ratings for bituminous coal, descriptive drawing showing assembly and method of feeding, components of the feeding assembly, model boiler room plan, and the many features of the stoker.

Canton Stoker Corp.



485—Induced Draft Fans

Bulletin L-3 covers the complete line of centrifugal induced draft fans. Included are rating tables shown at 600 F, dimension data, construction material specifications, recommended sizes of fans for oil, gas, or coal fired boilers. Typical installations are also shown.

*Lehigh Fan & Blower Division,
Fuller Co.*



486—Deaerators

Vertical and horizontal tray type deaerators for effective removal of corrosive gases from boiler feed water are the subject of booklet 28B8853. Principles of operation and important features are described. Technical data is presented in handy table form. Effluent capacities from 18,000 to 550,000 lb/hr.

Allis-Chalmers.



487—Rotary Positive Blowers

Series 400 and 600 rotary positive blowers, gas pumps, and vacuum pumps are described in bulletin S-65C, including dimension drawings and cutaways. Volumes up to 20,000 cfm single stage with pressures to 10 psi or vacuums to 20 in Hg. Features anti-friction bearings and wide-face herringbone timing gears.

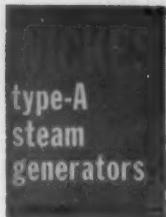
Sutorbilt Corp.



488—Steam Generators

Wickes type-A steam generators, compact, efficient, shop assembled water tube boilers, are illustrated and described in catalog 56-1. It gives typical superheater arrangements for the boilers with section, plan, and side views of drainable "S", pendant, and drainable superheaters. Specifications are given.

Wickes Boiler Co.



489—Spray Type Deaerating Heater

Bulletin WC-101-C contains complete details of Graver's spray type deaerating heater. Substantial savings in fuel are effected by recovering the heat in steam discharge. Cut-away shows operating details, chart of standard designs show type and application, features are described and illustrated. Accessories listed.

Graver Water Conditioning Co.



490—Packaged Air Preheater

The important points to consider in selecting a preheater for use with small boilers (25,000 to 250,000 lbs per hr) are discussed in four-page bulletin on the new package Ljungstrom air preheater. Explains how preheater saves fuel, increases boiler output and reliability, and permits use of lower grade fuels.

Air Preheater Corp.



491—Refuse Burners

Catalog 510 describes various methods of burning dry or wet bark, scrap wood, corn cobs, bagasse, spent coffee grounds, and other types of refuse on Detroit RotoStokers and RotoGrate Stokers. Refuse is burned separately or in combination with coal using automatic feeder systems.

Detroit Stoker Co.



492—Shot Cleaning System

Bulletin 2145 covers the new Diamond shot cleaning system for the most efficient and economical cleaning of such external horizontal tube surfaces as superheaters, reheaters, economizers, and air heaters. Gives advantages, principles, construction, and operation. Chart shows draft loss from ineffective cleaning.

Diamond Power Specialty Corp.



493—Double Rotation Turbines

Booklet, "The Durax Turbine" describes the Stal double rotation turbine. Multi-colored schematic drawings show clearly the operation of the turbine and its components. Multi-colored cutaway wash drawing in cover pocket opens to 23" x 33". One of these turbines is being installed by Detroit Edison, Detroit, Mich. ASEA Electric, Inc.



POWER EQUIPMENT & FUELS continued

**494—Monitor Packaged Boilers**

Bulletin AD 166 describes the new monitor packaged boiler which is designed to supply high pressure steam for food processing plants, laundries, chemical plants, dairies. Rated 15 to 60 hp, 150 psi. Burns oil, gas with equally high efficiency (minimum 80%). Pre-engineered, pretested in factory.

Cleaver-Brooks Co.

**495—Two-Pass Boilers**

Bulletin B-3232 describes Trojan 2-pass unit for heat and power. Features include complete wet-back construction, safe updraft gas passages, ease of maintenance, large furnace volume, and high thermal efficiency. Design details and size range of all Titusville Trojan boilers are given in this 4-page bulletin.

Titusville Iron Works Co.

**496—Vibra-Grate Stokers**

A water cooled vibrating grate stoker (sizes from 25,000 to 150,000 pounds of steam per hour) that does not require a dust collector and assures freedom from smoke, even at low ratings. Burns low grade coals with top efficiency and is easily adapted for burning gas or oil in combination with coal, or singly.

American Engineering Co.

**497—Compact Packaged Boilers**

Type C Superior Packaged Boilers for capacities from 20 to 350 bhp are described in this 3 color catalog. Unusually compact, providing economies of installation, the Type C has four-pass design, 5 sq ft of heating surface per bhp, and induced draft. Data and dimensions for units to burn oil, gas, or both.

Superior Combustion Industries, Inc.

**498—Factory Engineered Burners**

Factory engineered and built integral air register for control of combustion air is feature of Petro WR burner. Register controls entire air supply for maximum combustion efficiency. Models available for firing all fuel oils, including number 6, and for dual fuel oil-gas firing. For Scotch or firebox boilers.

Petro.

**499—Aftercoolers**

How aftercoolers remove moisture from compressed air and gas is explained in bulletin 130. Schematic flow diagrams show how aftercoolers can cool and dry compressed air systems in an plant. This eight-page, three-color bulletin is profusely illustrated. Full line of air engineering equipment shown on last page.

Niagara Blower Co.

**500—Steam Generators**

Bulletin AA-1-75910M describes the new low pressure air atomizing oil burner and new ring type gas burner. Provides more uniform flame pattern, burns cleaner, and provides more efficient combustion. Model AA Amesteam generators operate at top efficiency over a modulation range of 20% to 100% of rating.

Ames Iron Works, Inc.

**501—Refractory Fiber**

Bulletin IN-245-A is a reprint of article about how Cerafelt, a high temperature refractory fiber originally developed for jet planes, is replacing old style fireboxes in oil burning furnaces. Cities economic advantages of material, installation procedures, properties, temperature ranges. Photographs show advantages.

Johns-Manville.

To order personal copies of these bulletins, please fill out the card between pages 2 and 3 or 58 and 59.

**502—High Pressure Blowers**

Type HP Master Hi Pressure blowers for combustion air, jet pump operation, water blow-off, convection cooling, or any installation requiring steady air pressure or suction, are described in Bulletin 157. Blowers have shrouded impellers in sizes from 6 ounces to 2 pounds pressure. Fully illustrated.

Master Fan Corp.

**503—Packaged Boilers**

A completely new line of low and high pressure forced draft water tube packaged boilers is described in bulletin 1400. Known as the Compak series, these factory-tested units are offered in 22 sizes ranging in capacity from 12 through 750 horsepower. Engineering specifications with catalog literature.

International Boiler Works Co.

**504—Oil and/or Gas Fired Boilers**

Bulletin 1260 describes and illustrates Powermaster Model 3 line. Includes gas, oil and combination gas-oil models, a new specially designed hot water boiler, and the new steam atomizing principle for use with No. 6 oil. Ratings and dimensions of all sizes in line are included. Cutaway shows operation.

Orr & Sembower, Inc.

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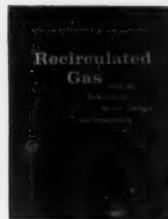
POWER EQUIPMENT & FUELS continued



505—Transfer Oil Heater

Bulletin 25A-1 describes the 100% automatic, no freezing, no corrosion operation of the Texsteam 25A transfer oil heater which provides temperatures to 600°F with low pressure vessels and flow circuits. Unit is gas or oil fired. Bulletin includes specifications and curve for sizing to specific applications.

Texsteam Corp.



506—Recirculated Gas

Bulletin G-96, "Recirculated Gas and its Relation to Boiler Design and Operation," is a booklet compiled by J. D. Andrew, Jr., A. M. Frendberg, and P. H. Koch. Contains definition of recirculated gas, its thermodynamic effect, mixing with combustion gas, and application to design and operation.

Babcock & Wilcox Co.



507—Positive Displacement Blowers

New bulletin RAS-158 describes positive displacement blowers of completely new design, in 36 sizes from 10- to 20-inch gear diameter. With capacities from 1900 to 14,500 cfm at pressures to 10 psig, these units feature direct-connected speeds, compactness, and a new impeller for safe handling of liquids.

Roots-Connersville Blower Division.



508—Packaged Boilers

Catalog VP-3, 16 pages, describes the new Type VP package boiler. Following a section of background information is an outline of principal design features. These boilers are shop assembled and provide steam capacities from 4000 to 90,000 lb per hr. Space requirements and specifications are in table form.

Combustion Engineering, Inc.

PUMPS & COMPRESSORS



509—Pumps and General Services

Bulletin 100, condensed list of services pertaining to water well systems, pumps, drilling, allied services, and equipment. Includes water wells, oil and water lubricated vertical turbine pumps, well screens, special pumps for many uses, irrigation, special drilling, water treatment, and service work.

Layne & Bowler, Inc.

512—Alloy Pumps

Catalog Section "M" describes the complete line of Viking alloy pumps ranging in capacities from $\frac{1}{4}$ to 300 gpm. Constructions include stainless steel, nickel, monel, mild steel, nodular iron, copper free ni-resist, white bronze, silicon bronze, and aluminum bronze. Catalog includes specifications, dimensions, operating data.

Viking Pump Co.



510—Centrifugal Pumps

Bulletin 110 describes Weinman Types LB and LLB single stage, double suction, split case centrifugal pumps for circulating and booster service. Pumps have 140 to 340 gpm ratings, at 20 to 150 ft heads. Bulletin gives sectional view with keyed parts list, specifications, and performance curves.

Weinman Pump Manufacturing Co.

513—Manual of Pumping Problems

"How to Solve Pumping Problems," 36-page instruction manual, covers important fundamentals of estimating requirements of the average pumping job. It contains sample problems on hydraulic systems, general transfer, and pressure transfer, plus tables, charts, and other pertinent engineering data.

Roper Hydraulics, Inc.



511—Metering Pumps

Catalog 900 describes the new line of Masterline metering and proportioning pumps. Available in four models with capacities to 1030 gph. New crank design features improved accuracy, parts interchangeability, operational efficiency, and ease of maintenance. Also featured is the new streamlined safety shield.

Hills-McCanna Co.



514—Turbine Pump Motors

A new turbine pump motor designed especially for short-coupled industrial pumping is described in bulletin F-1975, "U.S. Unibase Turbine Pump Motors." New microset coupling avoids disassembly for pump fine adjustment. Motor, base, coupling all are factory aligned, tested package.

U. S. Electrical Motors, Inc.

CONSULTING ENGINEER

PUMPS & COMPRESSORS continued

515—Air Compressors

Bulletin GO-259 on new line of air compressors constructed with carbon-graphite piston rings and skirts. Air is completely oil free because there is no oil in the air compressor. Models are available portable, tank-mounted and as tankless models. Capacities are $\frac{1}{4}$ hp to $\frac{1}{2}$ hp. Pressure's to 190 lbs. Specifications.

Bell & Gossett Co.



516—Suction Split Case Pumps

Bulletin 1200 describes Weinman double suction split case pumps for heavy duty pumping. Three types, L-1, L-2, L-3 for low, medium or high head service. Bulletin gives complete information including dimensions for 15 models available, lists features, and shows photographs of typical installations.

Weinman Pump Manufacturing Co.



517—Axial Flow Air Compressors

Listing 17 sizes of axial flow type air compressors for discharge pressures up to 15 psig, new bulletin LAH-158 covers requirements from 1000 to more than 12,000 cfm. Ratings are obtained at direct connected motor speeds, and the Spiraxial design requires neither internal lubrication nor cooling water jacket.

Roots-Conversville Blower Division.



518—Chemical Solution Pumps

Bulletin 2-340 describes Bruner's chemical solution pump. Model 17 complete package includes power drive, electric cord, plastic tubing, foot valve, automatic injection nozzle control, and instruction manual. Diagrams show operation for different uses. Features of pump are listed with various accessories.

Bruner Corp.



519—Multi-Drive Compressor Units

The new Brunner line of multiple drive compressors, $7\frac{1}{2}$ thru 40 hp, for industrial uses is described in Bulletin 775. In addition to product features, specifications are listed for refrigeration compressors, semi-hermetic, direct drive condensing units, and compressors. Capacity curves are presented.

Brunner Division, Dunham-Bush, Inc.



520—Abrasive Liquid Pumps

Folder SP-507 describes the complete new line of Viking abrasive liquid pumps. New ceramic bearings and mechanical seals incorporated in this equipment has doubled and tripled the pump life when handling paints and inks, as well as other abrasive materials. Folder includes specifications, and dimensions.

Viking Pump Co.



521—Heavy Duty Metering Pumps

Catalog 420.200, illustrated, describes new Series 200 pump line, with range from 0.65 to 2025 gals/hr. Each unit has 1, 2, or 3 liquid ends, and several units can be driven by one motor. Stroke speed is changed on one model while running, on another while shut down. Catalog gives description and technical data.

Wallace & Tiernan Inc.



522—Submersible Water Pumps

Bulletin B1300 describes Sumo's industrial size submersible water pumps from 3 through 125 hp at 3550 and 1750 rpm. Heavy duty pumps used for municipal water supply and booster systems, industrial and commercial buildings, institutions, and irrigation. Features are pointed out in cutaway photograph.

Sumo Pumps, Inc.



523—Short Coupled Service Pumps

Bulletin 300, includes cross section drawing of pump components and of suggested installations. It features the new Layne Stress Design head in cut-away, booster and service pumping for industries, cities requiring almost any pumping conditions. All sizes and capacities for power applications. Special pumps.

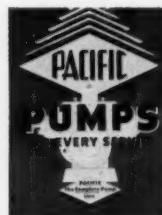
Layne & Bowler, Inc.



524—Farm and Industrial Pumps

Bulletin 1004, an illustrated table of contents of Pacific Pumping Company's general catalog. Gives brief digest of farm and industrial pumps; end suction centrifugal, horizontal split-case, regenerative turbine, boiler feed units, sump and sewage, axial flow, and others. Sizes, heads, capacities, and services.

Pacific Pumping Co.



525—Grout Pumps

Bulletin WS-150 contains data and specifications on grout pumps, the only Simplicity type for grout, slush, mud, and other heavy viscosity liquids. Pumps feature simplified heavy-duty design and can use air, steam, gasoline, diesel, electric motor or turbine drives.

*Wagener Pump Div.,
Canton Stoker Corp.*



526—Pumps and Blowers

California series rotary positive blowers, gas pumps, and vacuum pumps are described in bulletin S-59G with dimension drawings and capacity tables. For volumes up to 2480 cfm single stage with pressures to 10 psi or vacuums to 20 in. Hg. Features anti-friction bearings, wide-face timing gears, oil-free.

Sutorbilt Corp.



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PUMPS & COMPRESSORS continued



527—Centrifugal Pump Drives

Right-angle solid shaft gear drives, for centrifugal pumps and industrial use — cooling tower installations, barge service, sewage disposal, fire and flood control — manufactured in wide range of models to meet specific requirements, are described and illustrated with engineering details in eight-page catalog 29.

Johnson Gear & Manufacturing Co., Ltd.



528—Screw Pumps

Bulletins SE-5 and SI-6 describe line of screw pumps for heavy duty pumping of lubricating and nonlubricating fluids and semi-fluids, from 32 to 5,000,000 ssu; capacities 1 to 2000 gpm; discharge 1000 psi for viscous liquids, 500 psi for water. Internal or external bearing types, vertical or horizontal available.

Sier-Bath Gear & Pump Co., Inc.

STRUCTURAL MATERIALS & EQUIPMENT



529—"T-1" Steel Data

Booklet 01060 describes USS "T-1" steel, one of the most important members of the alloy family to appear on the scene in years. Contains cost comparisons, complete engineering data, metallurgical characteristics, fabrication practices, and applications. Profusely illustrated to show uses. Cuts costs, increases performance.

U. S. Steel Corp.



533—Fibre Conduit

Catalog 52 describes Orangeburg's standard and Noconcrete conduit for installation with and without concrete encasement. Manufacturing methods, advantages, and properties given. Method of joining and tooling pictured and explained. Fittings of various kinds are diagrammed and dimensions given.

Orangeburg Manufacturing Co., Inc.



530—Underfloor Distribution Systems

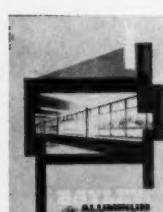
Bulletin 513 contains drawings, part numbers, and photographs of the three Spang duct systems for power, telephone, and intercom. Underfloor duct (for regular slab construction), headerduct (for cellular floors), and industrial duct (large capacity for heavy requirements in phone and intercom systems). Fittings described. *National Supply Co.*



534—Masonry Wall Reinforcement

This four-page bulletin is printed in two colors and describes Dur-O-wal masonry wall reinforcements. Included are features, advantages, physical properties, and general specifications. Information on cavity wall construction, rod deformation, bonding, and report of tests are also contained in this bulletin.

Dur-O-wal.



531—All Types of Aluminum Windows

Catalog A-60 describes the complete line of Bayley aluminum windows, including original Bayley features. The booklet includes such items as projected windows, pivoted windows, class room windows, ribbon windows, and detention windows. Dimensions, construction, design, fasteners, materials, and finish.

William Bayley Co.



535—Scaffold Shoring

Bulletin BP-10 describing Beatty scaffold shoring is composed of 6 pages and printed in 2 colors. Contains diagrams, shoring data tables, and description of frames. Wing-nuts and studs are replaced with labor-saving patented snaplocks. Various applications are pictured. Also described is Pecco shoring.

Beatty Scaffold, Inc.



532—Cellular Steel Floor Wiring

Bulletin C-7099 contains complete information on the General Electric cellular steel floor wiring system. Complete description, photographs, and dimensional drawings of all components are included. Contains layout design information, suggested specifications, application data, and installation instructions.

General Electric Co.



536—Steel Design Manual

First complete published manual containing design instruction for use of high strength steels. Includes fundamental characteristics, design considerations, working unit stresses, tension, compression, shear, deformation and deflection, formed sections, and design against corrosion. Engineering, not sales manual.

U. S. Steel Corp.

STRUCTURAL MATERIALS & EQUIPMENT continued

537—Structural Bolts

Catalog describes Lamson high strength bolts for buildings, bridges, towers, and other applications, that give maximum holding power. Bolting principles, ordering data, prices are included. Bolt is distributed by 20 U. S. Steel Supply Division Steel Service Centers in key locations throughout the country.

Lamson & Sessions Co.

**538—Rolling Doors**

Bulletin 104, 36 pages, is a complete catalog of the many types of doors made by Kinnear. It gives information on the types of operations, both manual and electrical; elevation drawings; mounting methods for various applications and locations; specifications; and explains special construction features of these doors.

Kinnear Manufacturing Co.

**539—Flooring, Grating, and Treads**

General grating catalog F-400 contains illustrations, descriptions, and complete engineering data on grating flooring, treads, and floor armoring (riveted, presslocked, and welded types). Irving grating is safe, durable, fireproof, ventilating, clean, and economical for industrial and power plant flooring and stairways.

Irving Subway Grating Co., Inc.

**540—Wire Rope Catalog**

A complete basic catalog for selecting wire rope for any use. Cross sections of different types of rope show construction. Rope diameters, breaking strength, and weight are given for all classifications. Well illustrated showing different uses. Wire rope fittings are illustrated.

American Steel & Wire Division,
United States Steel Corp.

**541—Pozzolith, Prestressed Concrete**

Bulletin P-13 explains how Pozzolith, the admixture for concrete, when used in prestressed concrete increases production and improves quality. Contains 16 case histories describing various applications in the use of Pozzolith. Each case history is completely illustrated with operational pictures.

Master Builders Co.

**542—Large Construction Fasteners**

Bulletin 160 covers large fasteners for the heavy construction and machinery industries. Large forged standard and special purpose nuts, bolts, threaded rods, loop rods, eye bars, construction accessories, size 1 1/4 in. thru 12 in. bolt diameter. Illustrated with photographs of standard and special large fasteners.

Jos. Dyson & Sons, Inc.

**543—Slag in Industrial Construction**

Bulletin ADUCO-80005 is a full color booklet designed to acquaint the consulting engineer with air-cooled, granulated, and expanded blast furnace slag. This general bulletin discusses slag in foundations, pavements and structures, flooring, railroad ballast, roofing, and flexible pavements. Advantages listed.

U. S. Steel Corp.

**544—Reinforced Plastic Panels**

Bulletin 1717RSF describes Stylux, the reinforced plastic panel, manufactured by Butler. Panels are used for commercial and industrial skylighting, window glazing, and ornamentation. Information especially for the use of consulting engineers includes specifications, product data, and installation details.

Butler Manufacturing Co.

**545—Steel Roof Deck**

Catalog 240 describes Inland's 5 broad lines of steel roof deck including new T-steel for spans to 32 feet. Included are features, section properties, load tables, construction details, installation procedures, and accessories. Information on Acoustideck, a roof deck and acoustical ceiling, is also presented.

Inland Steel Products Co.

**546—Insulating Concrete**

Bulletin C12 contains complete specifications, mixing, and application instructions for Permalite Perlite insulating concrete. Roof deck and floor fill applications are illustrated and discussed. Engineering data, including safe uniform loads, and physical properties on roof deck systems, are included.

Great Lakes Carbon Corp.

**547—Utility Deck**

Catalog U-601, January, 1960, illustrates and describes a multi-purpose, light gage, galvanized steel deck. Engineered specifically for short span construction and rigid insulation board. Provides fast, low-cost year-round construction. Catalog includes features, photographs, properties, and load tables.

Granco Steel Products Co.

**548—Steel-Concrete Studs**

Bulletin lists advantages of composite steel-concrete construction for both bridges and buildings, illustrates typical savings in steel. Illustrates shop and field installation of cost-saving Nel-weld shear connector studs, widely used in composite bridge and building.

Nelson Stud Welding Division
Gregory Industries, Inc.



DIRECTORY OF ADVERTISERS' LITERATURE

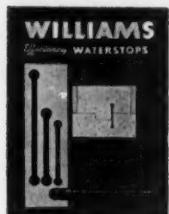
STRUCTURAL MATERIALS & EQUIPMENT continued



549—Prestressed Concrete Members

The rapid growth in the use of precast pretensioned bonded prestressed concrete members confirms their several advantages over competitive materials. Bulletin PC-945 describes application and production, and covers buildings, bridges, piles, casting bed details, and tensioning data. Fully illustrated.

John A. Roebling's Sons Division.



550—Waterstops

Four-page bulletin WS-59 covering complete line of rubber, vinyl, and neoprene waterstops with molded accessories such as unions, ells, tees, and crosses — both flat and vertical. Includes properties and characteristics, recommendations for use, methods of installing in formwork, and suggested specifications.

Williams Equipment & Supply Co.



551—Tubular Railings

A new bulletin on tubular railings has been prepared by Tubular Products, Inc. and is now ready for distribution. These are fitted and welded railings for industrial and commercial applications. They are ornamental and provide many safety features. Bulletin contains style drawings and photographs.

Tubular Products, Inc.



552—Chord Steel Joists

New 52-page bulletin contains complete data on Laclede straight chord steel joists, "S" and "L" Series. The bulletin includes numerous photographs, drawings and charts, plus such detailed information as design and construction features, dimensions and specifications, load and spacing tables, installation data. *Laclede Steel Co.*



553—Factory Built Steel Buildings

Bulletin ADUCO 30001 pictorially presents the various types of factory built steel buildings utilizing USS steels: galvanized roofing and siding, building frames from structural and plate steels, angles and bars, high strength steels. Advantages of steel building described and types of steel buildings diagrammed. *U. S. Steel Corp.*



554—Insulated Metal Walls

Insulated metal walls and wall panels of various types, and Underwriters' rated fire walls, with over-all "U" factor superior to that of a conventional masonry wall with furred lath and plaster, are described in 16-page bulletin W-58. Materials, construction, thermal properties are given, with construction details.

The R. C. Mahon Co.



555—Floor Gratings

Bulletin covers an improved conception for the installation of floor gratings, using the single-span divider-bar, combined with Borden's Type K reversible grating. Simplifies maintenance as well as installation. Bulletin pictures and describes installation at the new Public Service Generating Station, Linden, N. J.

Borden Metal Products Co.



556—Slag—Waste to Useful Material

Bulletin ADUCO-80-80004 is the reprint of a feature article in the April, 1958 issue of the U. S. Steel News. This article tells how blast furnace slag, once nothing more than a waste by-product of steelmaking, is becoming an increasingly valuable and useful material for the construction industry. Illustrated.

U. S. Steel Corp.



557—Cable, Wiring, Tubing Supports

Two systems of support for all types of cable, wiring, and tubing are described in a 28-page illustrated catalog. Systems are engineered to be used interchangeably, depending on the weight of the load to be supported at any location. *Globetray*, the ladder-type tray, and cable-strut, the basket type, described. *Globe Co.*



558—Wire Reinforcement Study

New studies conducted by an independent research foundation agree with previous reports that the replacement of header courses by wire reinforcement *correctly designed* does not reduce the transverse strength of a wall. In fact there is an increase in strength of about 12 percent. Illustrations of use. *AA Wire Products Co.*



559—Steel Buildings

Stran-Steel catalog 56-1-109 gives complete information on the complete line of rigid frame buildings and *Stran-Satin* color. Color coating is a double protective layer of vinyl-aluminum that is available in blue, green, rose, bronze, gray and white. It is applied directly to the ribbed wall and roof panels. *Stran-Steel Corp.*



560—Metal Tray-Seal

Bulletin SM-27-59 supplies general information, performance data, and results achieved by installation of *Tray-Seal*, Metal Textile Corporation's gasket materials which reduces leakage across fractionating trays. Photographs and drawings show product and application.

Metal Textile Corp.

Div. of General Cable Corp.

STRUCTURAL MATERIALS & EQUIPMENT continued

**561—Curtain Wall Systems**

Catalog C-60 outlines Bayley aluminum or steel curtain wall systems and insulated panels with Bayley aluminum projected windows. Advantages of Bayley curtain walls include choice of distinctive wall treatment without cost of special design, a wall engineered to accommodate a building's movement.

William Bayley Co.

**567—Service Fittings**

Bulletin 493 illustrates design features, simplicity of assembly of new *Spang* service fittings, suitable for use with underfloor distribution systems of any manufacturer. Covers individual power and phone fittings and includes illustrations of linoleum pan, terrazzo holder, plus part numbers, and ordering information. *National Supply Co.*

**562—Steel Underfloor Duct Systems**

Bulletin C-7089 describes General Electric's three steel underfloor wiring systems. Complete product information, layout design data, and suggested specifications can be found on G-E's single-level, standard duct, single-level big duct, and two-level duct systems. Photographs, and application data.

General Electric Co.

**568—Processed Blast Furnace Slag**

Bulletin ADUCO-80-80001 is a revised blast furnace slag insert prepared by the National Slag Association for inclusion in the current edition of Sweet's Catalog. Discussed are three types of slag; air-cooled, expanded, and granulated. Illustrated with graphs and photographs. Available publications listed. *U. S. Steel Corp.*

**563—Underfloor Duct System**

Catalog 203 describes the Orangeburg underfloor duct system, non-metallic underfloor raceways for distribution of electrical wiring in commercial, industrial, and institutional buildings. Drawing keyed to index shows components, which are also pictured and described. Instructions for installation given.

Orangeburg Manufacturing Co., Inc.

**569—Masonry Reinforcements**

The all new Sweet's brochure now available. AA Wire Products Company, manufacturers of masonry reinforcement and masonry ties, announce that the all new Sweet's brochure is now available. The new brochure features design drawings, photographs of installations, and suggested guide specifications.

AA Wire Products Co.

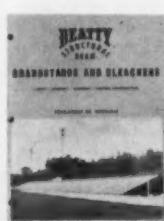
**564—Rubber Control Joints**

Four-page bulletin describes *Rapid* wide flange and *Rapid* regular rubber control joints for use in masonry walls. Included are features, advantages, physical properties, general specifications. Line drawings show both types with dimensions, also method of application are included in this bulletin.

Dur-O-wal.

**570—Expanded Metal Partitions**

New catalog describes *Globe Safe-Guard* expanded metal partitioning with exclusive *Quick-Erect* patented fittings for easy method of guarding conveyors and machines and for all in-plant partitions. Catalog shows method of erection of prefabricated panels, full range of sizes available, and complete engineering data. *Globe Co.*

**565—Grandstands and Bleachers**

Bulletin BB-1 describes the Beatty structural beam grandstands and bleachers. Features and specifications together with seating capacities in table form are given. Portable Rollway bleachers for either outdoor or indoor use are shown. Diagram shows general design of beam-type bleacher. Various installations pictured. *Beatty Scaffold, Inc.*

**571—Steel and Aluminum Grating**

This 16-page catalog shows the three basic types of grating construction; gives more than 30 dimensional drawings of subtypes; eight safe load tables covering steel and aluminum grating, roadway grating, and sidewalk slabs; tables on panel widths, tread widths, and floor armor. Planning layouts are given. *Borden Metal Products Co.*

**566—Steel Joists and Studs**

Stran-Steel catalog gives complete information, properties, and dimensions for lightweight nailable steel joist and studs, punched channel studs, channels, columns, beams, zee sections, wide flange beams, roof deck, ribbed decking, and metal curtain wall panels. Fully illustrated with photographs and drawings. *Stran-Steel Corp.*

**572—Long Span Decking**

Installation data and detail drawings are given in 16-page catalog LSD-58 for use of long span M-decks. They have been especially designed to provide a better balanced, more efficient structural unit for roof and combined roof-ceiling construction. Includes acoustical treatment and lighting.

R. C. Mahon Co.

DIRECTORY OF ADVERTISERS' LITERATURE

STRUCTURAL MATERIALS & EQUIPMENT continued

573—Prestressed Concrete

New 12-page bulletin describes the production, application, and characteristics of Laclede 7-wire strand prestressed concrete. Numerous photographs and text illustrate the entire manufacturing operation. Bulletin also includes typical load elongation curves on $\frac{3}{8}$ " and $\frac{7}{16}$ " diameter strand, A.S.T.M. specifications. *Laclede Steel Co.*



574—Concrete-Filled Columns

Concrete-Filled Columns: complete illustrated literature on pipe columns, square and rectangular tube columns, including safe loads, physical properties, and sample computations. Most fire-resistant, nonfire-proof column made, your key to better, safer construction. Types of columns and connections shown. *Tubular Products, Inc.*



575—Seals and Gaskets

Four-page bulletin SG-659 covering complete line of *Weatherite* seals for various types of control joints in block constructed walls. It also covers masonry gaskets of nonabsorbent elastomer for use between sill and coping stones, brick or stone wall panels, and masonry and structural steel members. *Williams Equipment & Supply Co.*



576—Bearing Bolts

Engineering, ordering data on new Lamson high strength bearing bolts for buildings, bridges, towers, and other applications. Bolt has highest shear strength, greatest resistance to slip of all structural bolts. Distributed by 20 U. S. Steel Supply Division Steel Service Centers throughout the country. *Lamson & Sessions Co.*



577—Rolling Counter Shutters

Bulletin 103 describes the Kinnear rolling counter shutters with midget slats. These metal shutters afford protection against weather, pilfering, or illegal entry. End photographs show construction of slats. Diagrams show dimensions for both crank and push-up operation. Includes specifications and special features. *Kinnear Manufacturing Co.*



578—Construction Products

Bulletin ADUCO-25638 deals in condensed form with sheet piling, bearing piling, concrete reinforcing bars, galvanized steel sheets, culvert sheets, and arch culverts. Uses and features included. Photographs show applications of various products. Diagrams, dimensions, and specifications. *U. S. Steel Corp.*



579—Prestressed Wire and Strand

From a pioneer in the prestressed concrete field comes a new catalog entitled "USS American Wire and Strand for Prestressed Concrete". The important phases and applications of prestressed concrete and the role American Super-Tens Wire & Strand plays in this industry are shown. *American Steel & Wire Division, United States Steel Corp.*



580—Open Metal Decking

Irving decking catalog F-300 contains illustrations, descriptions and engineering data on open metal grid bridge roadways, with many of the advantages inherent in this type of bridge roadway, such as light weight, cleanliness, drainage, safety, durability, strength, traction, and economy. *Irving Subway Grating Co., Inc.*



581—Monopanl Walls

Bulletin 1728 is a data and specification form outlining, for the consulting engineer, product information and specifications on a new self-sealing insulated wall panel with no visible joints. Butler's new *Monopanl* forms a complete wall, inside and out, factory cut to fit a pre-engineered structural system. Details pictured. *Butler Manufacturing Co.*



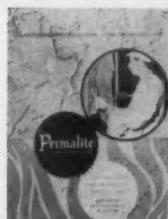
582—Steel Curtain Wall

Booklet 91791, entitled "Walls of Steel," fully discusses the selection, fabrication, and erection of steel curtain wall for many recent commercial and industrial buildings. The book is illustrated in full color and describes the use of steel panels as spandrels, column covers, and mullions. Practical and economical. *U. S. Steel Corp.*



583—Plaster Aggregate

Bulletin PI2 contains complete plastering specifications and fireproofing data for *Permalite* Perlite plaster aggregate, used as lightweight fireproofing on ceilings, walls and partitions, columns, and beams. Characteristics, advantages, mixing, and application instructions included. Contains charts of typical fire ratings. *Great Lakes Carbon Corp.*



584—Pozzolith Bridge Concrete

Bulletin P-11 describes *Pozzolith* used in bridge concrete for better quality control. Contains many case histories with operational photographs and diagrams. Included is description of its use in 200 Ontario highway bridges as well as the Barnhart Island bridge of the St. Lawrence Seaway project. *Master Builders Co.*



CONSULTING ENGINEER

STRUCTURAL MATERIALS & EQUIPMENT continued



585—Large Hot Pressed Nuts

Bulletin 459 contains prices, weights, keg quantities, dimensions of American standard heavy large hot pressed nuts, Hexagon and square used in heavy construction for buildings, bridges, towers, all types of big construction jobs. Size 1½ in. thru 4 in. bolt diameter. Steel and engineering specifications.

Jos. Dyson & Sons, Inc.



591—Slag for Road Construction

Bulletin ADUCO-80-80011 is a reprint of a two-page article discussing the various uses of both air-cooled and granulated blast furnace slag in paving several roads with bituminous concrete. Cross section of a typical flexible bituminous concrete pavements shown. Photographs of actual paving operations. *U. S. Steel Corp.*



586—Concrete Slab Reinforcement

Catalog BC-602 gives complete information on a reinforced concrete floor system with built-in underfloor electrification. Described in detail is Standard *Cofar* (without electrification) and E/R *Cofar* (with complete electrification.) Includes advantages, properties, fire tests, and specifications.

Granco Steel Products Co.



592—Stud Welding in Construction

Bulletin details the major cost-saving applications of Nelson's split-second method of fastening to steel or aluminum. Process is described and illustrated. Typical applications include field-assembled sandwich walls, single skin metal roofing and siding, shear connectors, concrete anchors, and others.

Gregory Industries, Inc.



587—Simple-Span Concrete Beam

Engineering data sheet PC-946 is entitled "Design Procedure for a Simple-Span Prestressed Concrete Beam." This technical bulletin is based on ACI-ASCE Committee 323 report "Tentative Recommendations for Prestressed Concrete." An excellent guide for engineers designing prestressed concrete members.

John Roebling's Sons Corp.



593—Open Web Steel Joists

The Steel Joist Institute's Standard specifications and Load Tables, 1960 Edition, provides complete information on the advantages, design, application, and characteristics of open web steel joists, both the "S" Series and the "L" Series. The 36-page booklet includes numerous drawings, charts, and tables.

Steel Joist Institute



588—Steel Concrete Forms

Catalog 245 describes Inland *Ribform*, a permanent steel form for concrete floor and roof slabs. *Ribform* is fabricated from high tensile steel in lengths to meet specifications. Erection is quick and easy. Available in standard, heavy-duty, and super-duty weights; black (uncoated) and galvanized steel finishes.

Inland Steel Products Co.



594—Silaneal Treatment for Brick

This 4-page, illustrated brochure, 8-303, shows why construction is faster, building costs are reduced, and masonry is protected from efflorescence, staining, spalling, through future years. Included is a statement suggesting architectural specifications for *Silaneal(R)* treated bricks.

Dow Corning Corp.



589—Tunnel Liner Plates

Catalog TL-7858 describes how Armco liner plates are used to line old masonry and concrete structures, serve as mine entry shafts, caskets, above ground structures, and storage bins. Contains engineering data, tables, graphs, and other essential information, including many diagrams and photographs.

Armco Drainage & Metal Products, Inc.



595—Machinery Grout

New machinery grout five times stronger than concrete offers unique combination of oil and chemical resistance, excellent bond to metal, high compressive and tensile strength. It is fast-hardening and nonsetting. No. 648 Grout is especially recommended for permanently seating machinery subjected to severe conditions.

Cellcote Co., Inc.



590—High-Strength, Low-Alloy Steel

Bulletin ADUCO-02018 discusses general properties, mechanical and performance characteristics, and economic advantages of USS *Cor-Ten* high strength steel. The booklet is profusely illustrated showing many applications of USS *Cor-Ten* steel in a variety of industries. Various operations in fabrication shown.

U. S. Steel Corp.



596—Building Wire

Bulletin RCP-3001 describes Synthinal 901 building wire for hazardous industrial locations, such as found in oil refineries, industrial plants, and chemical plants. Physical and electrical characteristics are given. Detailed coverage on Type T or TW - 600 volt building wire. Specifications and illustrations.

Rome Cable Division of Alcoa.

DIRECTORY OF ADVERTISERS' LITERATURE

STRUCTURAL MATERIALS & EQUIPMENT continued

597—Industrial Doors

Sixteen-page catalog describes the types of doors manufactured and installed for industrial building and aircraft hangar installations. Included are canopy type, motorized slide, turn-over, and vertical lift doors. Doors such as for crane entrances and the *Byrna-perture* for hangars are also described and illustrated.
Byrne Doors, Inc.



598—Metal Grating and Stair Treads

This 16-page, 2-color bulletin is a picture story of Kerrigan Iron Works. Shows how grating is fabricated into various forms and cutouts. Bulletin contains standard table of safe loads, engineering data, data on various types of anti-skid stair treads, and testing methods. Pictures grating types and stair treads.
Kerrigan Iron Works, Inc.



To order personal copies of these bulletins, please fill out the card between pages 2 and 3 or 58 and 59.

599—Dome Slab Construction Material

Manual 4007 gives sizes, erection procedures, typical arrangements, design data, and typical installations for this new method of forming "waffle type" two-way dome slab construction with one-piece forms especially designed for exposed ceiling construction. Gives features, removal procedures, and outlines services.
Ceco Steel Products Corp.



600—Welded Steel Grating

New eight-page illustrated bulletin describes Gary welded steel grating and treads. Has easy-to-use table of safe loads, weights and symbols, and panel widths. Included is data on fastening devices illustrated by drawings. Information on specifying grating and treads.
Rockwell-Standard Corp., Grating Division.



601—Glass-Protected Smokestacks

Bulletin SS-202A describes *Permaglas* smokestacks, protected against corrosive flue gases. Features include longer life, low maintenance, lightweight, and easy installation. Chart shows how *Permaglas* stacks cost less over a period of years. Special *Permaglas* sections, smokestack accessories, and typical installations.
A. O. Smith Corp.



602—Duct Floors for Electrification

Sixteen-page booklet, "Electrical Outlets Wherever You Need Them," gives complete details on RLC duct floors, a new development which provides 100 percent electrical flexibility for buildings at a remarkably low cost. The illustrated booklet is published by the Concrete Steel Reinforcing Institute.
Concrete Steel Reinforcing Institute.



603—Access Locks

Bulletin 451 describes standard size low pressure and high pressure nuclear containment shell access locks, both automatic and manual. Operating and safety features are listed and described and specifications given. Offers not only personnel locks but equipment locks, escape lock, and special locks.
Henry Pratt Co.



604—Stainless Steel Walls, Roofs

Bulletin ADUO-03-19014 contains a comprehensive discussion of the many advantages of stainless steel walls and roofs for industrial and semi-industrial buildings. Pertinent data section includes corrosion resistance, characteristics, grades, thickness, and forms and finishes. Comparative erection costs.
U. S. Steel Corp.



605—Fluted Steel Foundation Piles

Catalog No. 91, 24 pages, contains information on physical properties and design features, standard weights and volumes of Monotube fluted, steel foundation piles. Included are photos of typical installations, test driving data, and other technical data of particular interest to consulting engineers.
Union Metal Manufacturing Co.



606—Aluminum Roof Curb

Bulletin SCE-89 describes self-flashing extruded aluminum *Sonotrol* roof curb. Easily installed, it provides a structurally stable support for the roof exhauster or motor or gravity operated dampers. This device helps to reduce sound buildup developed by roof fans. Installation instructions, drawings, specifications.
Penn Ventilator Co. Inc.



607—Steel Rope

This publication contains information required for selection and preparation of specifications for wire, strand, and rope used on guyed structures and suspended systems of all kinds, except major suspension bridges. Both standard and special fittings for use with bridge strand and bridge rope are illustrated.
John A. Roebling's Sons Corp.



STRUCTURAL MATERIALS & EQUIPMENT continued

608—Prestressed Strand

Booklet P-110 explains in detail the basic principles of prestressed concrete. Typical applications, such as I-beam and box-beam bridges, industrial and commercial buildings, stadiums, grandstands, and reservoirs are illustrated and described. Technical data included.

*H. K. Porter Company, Inc.
Leschen Wire Rope Division.*

**609—Galvanized Roofing and Siding**

Bulletin ADUCO-30305 describes 1½ in. and 2½ in. corrugated, 5-V crimp and *Stormseal* galvanized steel sheets. Advantages are listed. Roofing accessories pictured and described. Section on installation procedures together with 14 application tips. Method of computing and table of weights included.

U. S. Steel Corp.

**WASTE DISPOSAL EQUIPMENT****610—Treatment Tanks**

Bulletin AET-59 contains full-color illustrations of water and effluent treatment tanks. They are steel-reinforced concrete structures faced on both sides with vitrified tile laid with corrosion-resistant mortar. Tanks are exceptionally attractive in appearance. Included are drawings showing wall construction.

Stebbins Engineering and Mfg. Co.

**611**

Bulletin DJ-60 describes the *Delta-Ject* packaged pneumatic sewage lift station manufactured by Tex-Vit Supply Company, Manufacturing Division. A duplex unit available in 29 to 200 gpm, it features exclusive shell-within-shell design. Bulletin provides engineering data, specifications, and dimensional drawings.

Tex-Vit Supply Co., Mfg. Division

**612—Turbine-Type Blowers**

The Spencer Turbine Company's bulletin 142-B describes and pictures the company's line of blowers for use on industrial and municipal applications (particularly sewage treatment plants) wherever delivery of clean air is required. Features and advantages of the Spencer turbine type blowers are described.

Spencer Turbine Co.

**613—Small Plant Sewage Treatment**

Bulletin 6692 describes Dorr-Oliver equipment for small plant sewage treatment which brings big plant results within the reach of the small community. Bulletin details the plant system; lists its many advantages; gives complete specifications. Photographs show installations and diagrams show equipment.

Dorr-Oliver, Inc.

**614—High Capacity Aerator**

Bulletin 7316 describes the D-O Aerator for application in both municipal sewage and industrial waste treatment plants. Can be adapted to a variety of tank sizes and is readily incorporated into existing tanks. Cutaways show aerators installed in round tank as well as in rectangular tank. Diagrams show flow.

Dorr-Oliver, Inc.

**615—Corrugated Metal Sewer Lines**

Catalog CMS-7458 describes the structural durability of Armco's corrugated metal sewer structures, as compared to other types of sewer structures. Features, selection data, factors influencing capacities, joints and fittings, and general installation and design data. Completely illustrated with drawings and photographs.

Armco Drainage & Metal Products, Inc.

**616—Waste and Drainage Systems**

Engineering handbook on properties and performance of Vulcathene Waste and Drainage Systems. Describes complete range and type of Vulcathene fittings, sinks, traps, and pipe. Contains technical and dimensional data, and engineering drawings. Explains patented *Polyfusing* method for joining Vulcathene fittings.

American Vulcathene Division.

**617**

Bulletin PS-60 describes the Tex-Vit packaged sewage pump station. Available in 50 to 2,000 gpm capacities, these are duplex units complete with motors, pumps, controls, dehumidifying unit, corrosion-resistant steel shell, and entrance tube. Bulletin includes engineering data, specifications, and dimensional drawings.

Tex-Vit Supply Co., Mfg. Division



To order personal copies of these bulletins fill

DIRECTORY OF ADVERTISERS' LITERATURE

WATER TREATMENT EQUIPMENT

618—Upflow Clarifiers

In bulletin 5811 models C, CP, CPS, P and CF of General Filter Company's upflow clarifiers are described and illustrated. Flow charts and important features, essential to economical and efficient operation, are included. Typical contraflow industrial, utility, and municipal installations are shown and described. *General Filter Co.*



619—Water Filtration Equipment

Bulletin 804 describes new diatomite filter. Elements of woven wire and stainless steel coil support diatomite filter media and provide unrestricted flow. "Breather" action of elements cause instant release of spent diatomite and swirl flushout assures its complete removal. Sand filters also described. *Elgin Softener Corp.*



620—Automatic Control Systems

Bulletin E describes the automation of ion-exchange and water treatment equipment. A suggested specification is included, together with typical illustrations and descriptions of important design features. Automatic control systems described are adaptable to any automatic valve sequencing operation. *Illinois Water Treatment Co.*



621—Filtration Plant Valves

The only valves specifically made for water filtration plants are shown in bulletin W-18. Complete specifications are given for drain, backwash and rewash valves. Valves can be remotely operated by electricity, air, or water. Actual opening and closing power is supplied by the line pressure itself. *Golden Anderson Valve Specialty Co.*



622—Diatomite Pressure Filters

Bulletin 2-323 covers the line of Bruner diatomite pressure filters for swimming pools. Standard filters are available in sizes from 12 to 672 sq ft. Features include a septum with interlocking plastic disc core and plastic cloth sleeve. Schematic diagrams and comparison charts for diatomite and sand filters. *Bruner Corp.*



623—Evaporators

A 24-page booklet describes Maxim evaporators: steam, heat recovery, flash, steam jet compression, and vapor compression. Tells about Maxim's marine test station for pre-testing and R & D under marine conditions. Describes typical power-water plant, high purity makeup feed water, gives engineering data. *Emhart Mfg. Co., Maxim Division.*



624—Water Gate Hoists

Catalog GH-353 describes gate hoists specifically designed to control water levels on hydro-electric power plant installations. Illustrates some typical hoists. Lists types of stationary and traveling gate hoists and the types of power dam gates for which they are applicable. Capacities from 1 to 100 tons. *D. J. Murray Manufacturing Co.*



625—Ion Exchange Units

Sixty-page manual Z-5 explains ion exchange water conditioning processes, the resins and equipment used, quality of water produced, and typical costs involved. Designed as a practical handbook to aid engineers in proper selection and operation of ion exchange units in water conditioning applications. *Nalco Chemical Co.*



626—Filter Plants

Filter plants for the removal of iron, manganese, taste, odor, and gas are described in a new General Filter bulletin. Various problems are listed and answers given. Four basic treatment methods are described and graphically shown in drawings. Actual installations in all parts of the country are shown. *General Filter Co.*



627—Cation Exchanger

Bulletin Z-12 presents complete technical information on Nalco HCR-W, new stress free cation exchanger. Explains hydrogen cycle and sodium cycle operations and discusses use of HCR-W in industrial and municipal applications. This product is manufactured by the Dow Chemical Co. for Nalco. *Nalco Chemical Co.*



628—Single Control Valve

Bulletin WC-122 describes the Graver Monotrol® single control valve for use with ion exchangers, zeolite softeners, and filters. Available in cast iron or corrosion-resistant plastic for manual or automatic operation. Schematic flow diagram, design and operating features, and recommended valve construction chart. *Graver Water Conditioning Co.*



629—Junior Deionizer

Up to 120 gallons of deionized water per hour is delivered by the Junior 120 Deionizer described in Bulletin 513. Ion exchange resin bags are lifted out when exhausted and exchanged for factory regenerated refills. Made of stainless steel, this deionizer is ideal where a large unit is not required. *Elgin Softener Corp.*



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